MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 38 MARCH, 1932 Number 7

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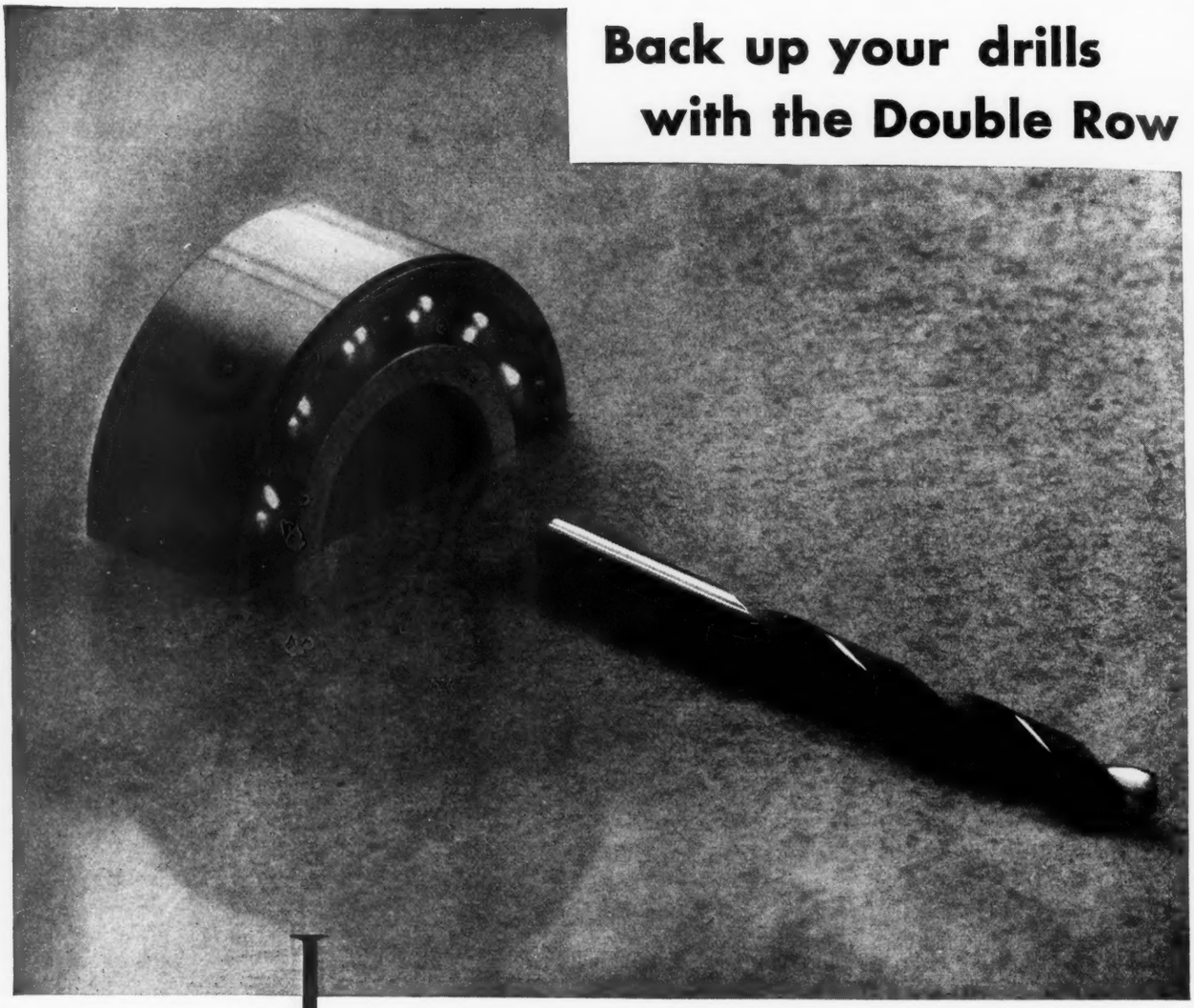

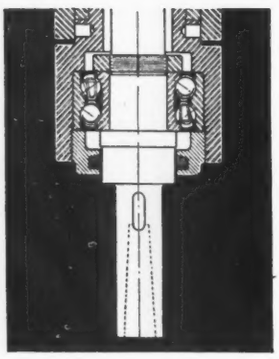

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MACHINERY

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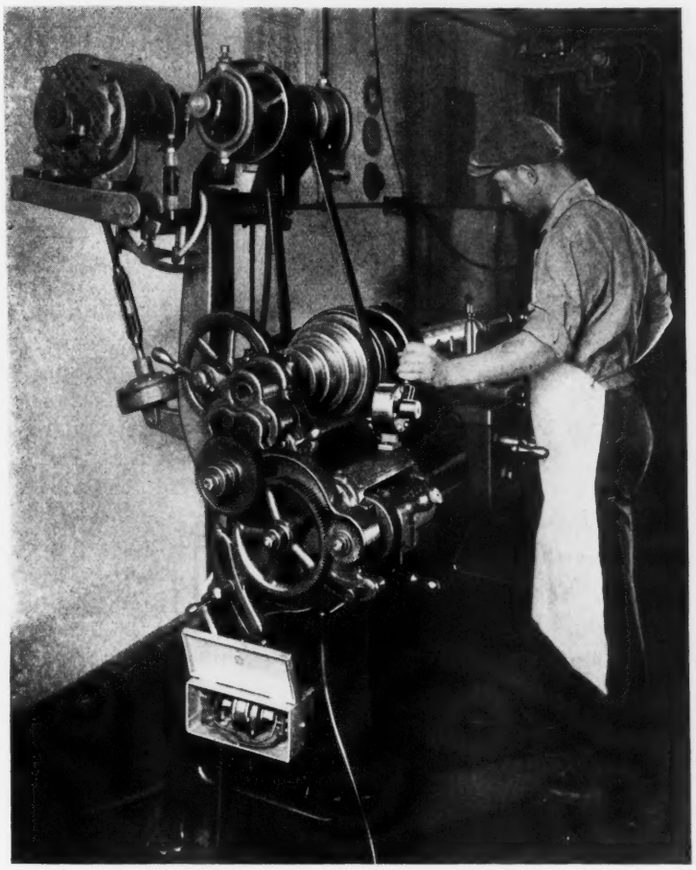


Air Brakes on Machine Tools

If Air Brakes Can be Used to Stop a Train, Why Not a Machine Tool?—A New Application of Compressed Air in Shop Operation

By L. J. BERKELEY
Manager, Spiroil Company, Cleveland, Ohio

COMPRESSED air has long been a popular medium in metal-working plants for driving such portable tools as drills and hammers and for operating pneumatic hoists. Until within recent years, however, shop men have looked askance at the application of compressed air to machine tools. With the development of air-operated chucks shop men began to realize the advantages of pneumatic appliances on machines, and since then they have become more and more "air-minded."

The writer has gone a step farther than most designers by adopting air-operated brakes for machine tools. Such brakes enable the machines to be stopped instantaneously. By driving the machines with reversing-type motors, the rotation of the tool on drilling or milling machines, and the rotation of the work on lathes, can be immediately reversed. Full use of these advantages can be taken in tapping operations, where it is desired to withdraw the tap after it has been fed in to the desired depth. In

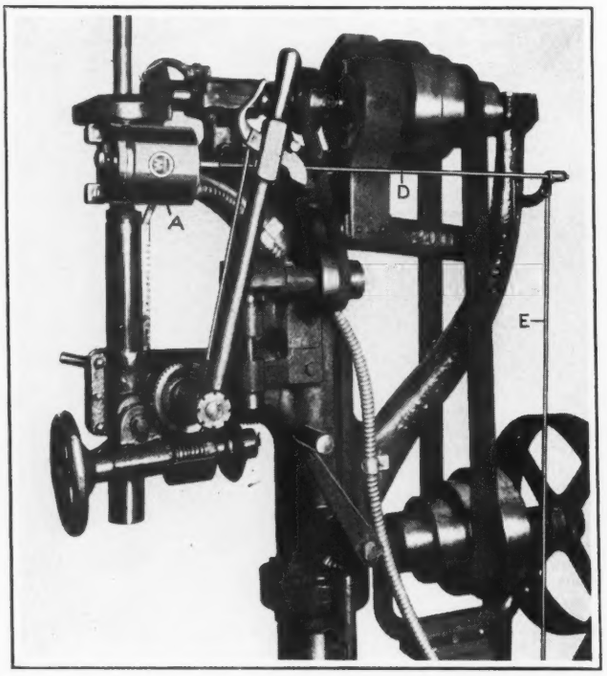
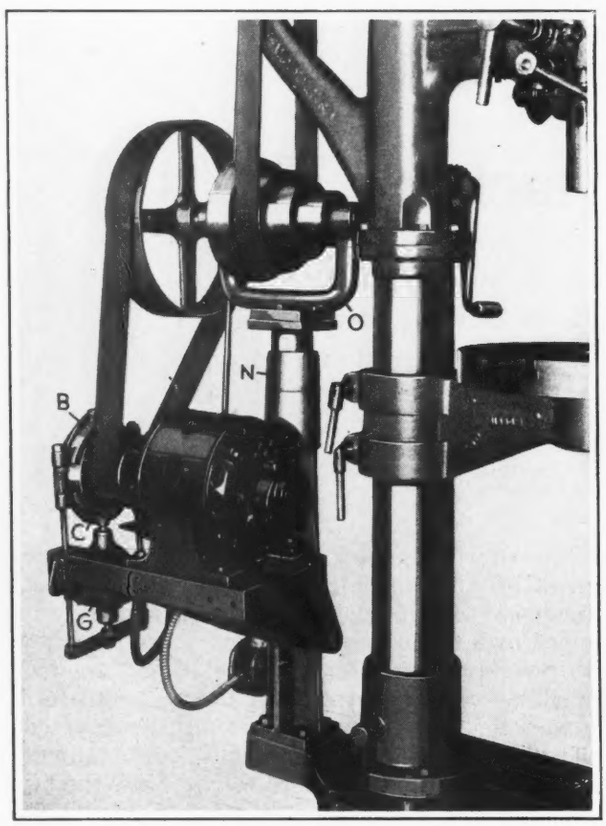


Fig. 1. (Above) The Drum Type Electric Switch A Controls the Operation of the Motor and Air Brake of this Machine Fig. 2. (Below) Drilling Machine Equipped with an Air Brake and Arranged to Provide Uniform Tension in the Belts



lathe work, the advantages permit threading close to shoulders and similar operations to be performed. Also, the tool or work, depending on the type of machine, can be rotated by very small amounts in a manner analogous to "inching" on a shaper or planer.

In addition to being equipped with air brakes, the machine tools in the shop of the writer have been provided with means of maintaining a constant tension in the driving and countershaft belts. Quick belt-shifting features have also been devised. All these features are particularly advantageous in jobbing or experimental shops, where the nature of the work changes constantly and it is desired to alter speeds frequently.

The Air Brake of a Drilling Machine

Figs. 1, 2 and 4 show an upright drilling machine provided with the features that have been referred to. Instantaneous stopping of the machine and quick reversal of the motor are effected through a Westinghouse drum-type switch, installed on the machine as shown at *A* in Fig. 1. When the handle of the switch is in the neutral position as illustrated, the air-brake shoes *B* and *C*, Fig. 2, are applied to a flange on the motor pulley. As the switch handle is moved upward, the air brake is released and current is supplied for driving the squirrel-cage polyphase induction motor in the forward direction. When the handle is moved downward from the neutral position, the air brake is again released and the current drives the motor in the reverse direction. Thus holes can be tapped without the necessity of special equipment.

The air brake is operated through rods *D* and *E*, Fig. 1, which connect the drum switch to air valve *F*, Fig. 4, near the bottom of the machine. When this valve is open, it admits air into cylinder *G* through hole *H*, Fig. 5. The air forces the two rubber diaphragms *J* and *K* apart, and this action moves pistons *L* and *M* upward and downward, respectively. From Fig. 6 it will be seen that these pistons, in turn, clamp the brake-shoes tightly on the flange of the motor pulley. The movement of each brake-shoe is about 1/8 inch.

When the air valve *F*, Fig. 4, is closed preparatory to starting up the motor in either direction, the air is exhausted from the cylinder through the action of the coil springs that surround the piston shanks, as seen in Fig. 5. An air pressure of from 40 to 60 pounds per square inch is used. The piston heads are about 2 inches in diameter. The brake-shoe linings are of the automotive type.

How Uniform Tension is Maintained on the Driving and Countershaft Belts

The motor and the air-brake equipment are mounted on a welded-steel shelf which is hinged on upright *N*, Fig 4, in such a manner that the weight of the entire unit hangs on the driving belt. With this arrangement a uniform tension is maintained in the belt.

Uniform tension is also maintained in the countershaft belt by mounting the lower countershaft pulley on a bracket *O*, which is attached to an arbor that has a sliding fit in a sleeve of upright *N*. Thus the weight of the motor unit also acts on the countershaft belt. The arbor of bracket *O* has a spline that engages a key to prevent it from turning in its sleeve.

When it is desired to change the countershaft belt from one set of pulley steps to another, the operator merely depresses treadle *P*. This raises bracket *O* sufficiently to remove all tension from the countershaft belt, so that it can be shifted with ease.

Air-Operated Switch for Lathe Motor

The motor and air brake of the engine lathe shown in the heading illustration are both controlled by the five-position air valve that the operator is seen grasping with his left hand. When this handle is in the neutral position, the machine is stopped, because the air brake is being applied to the motor pulley and no electric current is being supplied to the motor. When the handle is moved past the neutral position, to the right, the air brake is released preparatory to starting the motor, and then as it is moved further, to the extreme right, an electric switch is closed by means of air to deliver current for driving the motor in the forward direction.

Conversely, if the handle is moved from the central position to the left, the air brake is released, and when the handle reaches the extreme left-hand position, the motor is run in the reverse direction. The lathe may be stopped instantly or the intermediate positions of the valve between the braking position and the running positions may be used to let the machine stop of its own accord as the momentum runs down. The movement of the handle from one extreme to the other can be accomplished rapidly.

The air-operated motor switch is mounted on the headstock leg, as seen in the heading illustration. The details of this switch may be studied from the cross-sectional view in Fig. 7. Copper tubes carry the air from the control valve to this switch. It will be seen that the switch unit comprises a central air cylinder *A* of double design. The air is admitted into one side and acts against a rubber diaphragm, pushing piston *B* outward, so as to close the electrical contacts mounted on fiber bars *C*. In this way, electric current is delivered to the motor for driving it in the forward direction. The opposite side of the unit is of similar construction, having a piston that is forced to the right to close the contacts on fiber bars *D* when it is desired to supply electric current for driving the motor in the reverse direction. Both the five-position air control and the air-operated electric switch were designed by the writer.

Arrangement of the Lathe Drive

The air brake employed on this lathe is similar to that illustrated in Fig. 5. It is mounted on the motor bracket, as shown in Fig. 3. When air is ad-

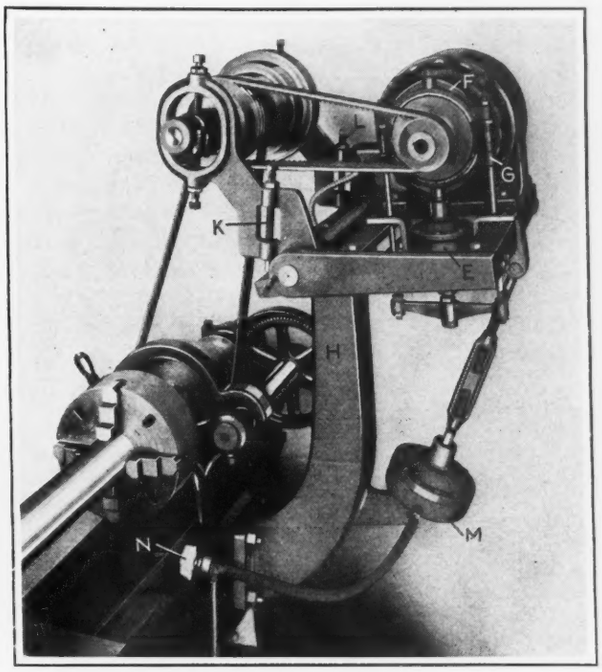
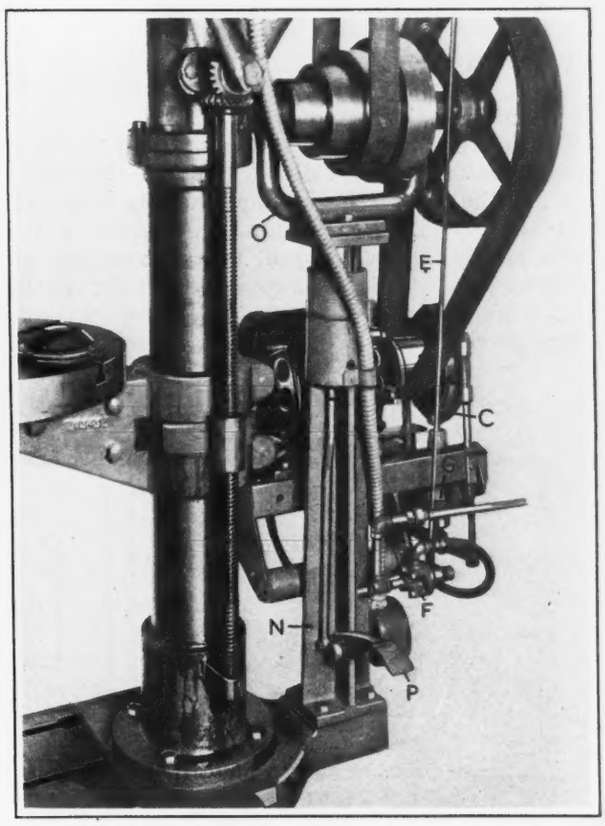


Fig. 3. (Above) Air Brake and Drive of the Engine Lathe Shown in the Heading Illustration. Fig. 4. (Below) A Simple Arrangement Provides for Producing Slackness in the Countershaft Belt to Facilitate Easy Shifting to the Different Pulley Steps



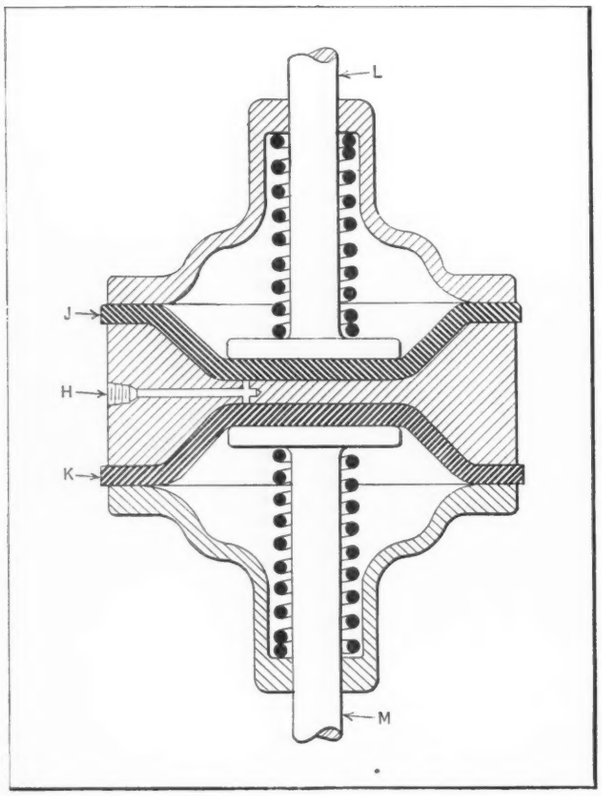


Fig. 5. Cross-section View which Shows the Details of an Air Brake Cylinder Such as at G, Figs. 2 and 4

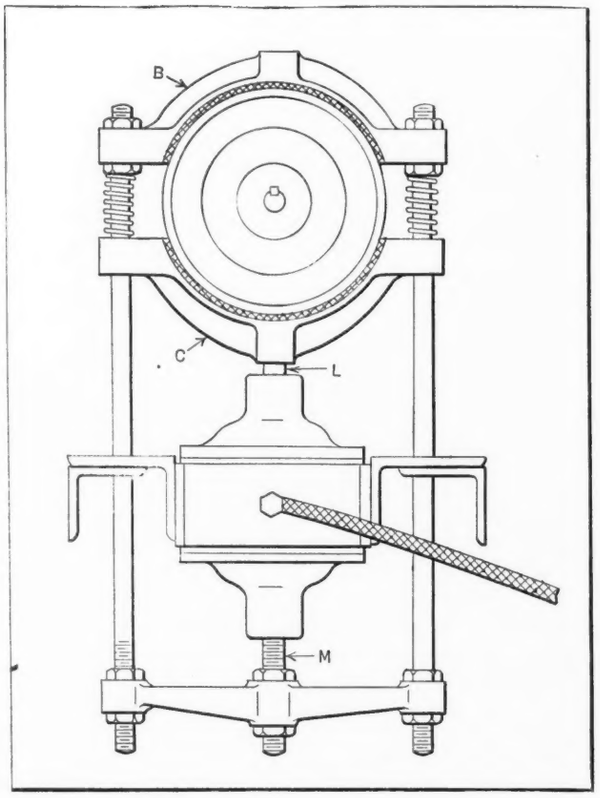


Fig. 6. Diagram Illustrating the Manner in which the Power of the Air Cylinder is Conveyed to the Brake-shoes

mitted into cylinder *E*, shoes *F* and *G* grip the flange of the motor pulley firmly and instantly stop the running of the machine.

The desired tension is obtained in both the driving and countershaft belts by hinging the motor base and the countershaft pulley brackets to the top of arm *H*. With this design, the weight of the motor can be applied to pull up the countershaft pulley and thus subject the countershaft belt to the desired amount of tension.

The drive from the motor to the countershaft pulley is through Dayton Cog-Belts. Screws *K* and *L* enable the distance between the centers of the driving and countershaft pulleys to be varied, and thus provide a means of adjusting the tension in these belts.

Air cylinder *M* is employed to relieve the countershaft belt of all tension when it is desired to shift this belt on the pulley steps. By merely turning thumb-switch *N*, air is admitted to the cylinder, pushing the piston upward and with it the entire motor and countershaft pulley unit. The motor is raised approximately 1 1/4 inches by the piston in cylinder *M*.

Fig. 8 shows a drive applied to another engine lathe which differs somewhat from the drive of the lathe just described in that the air brake consists of a one-piece band

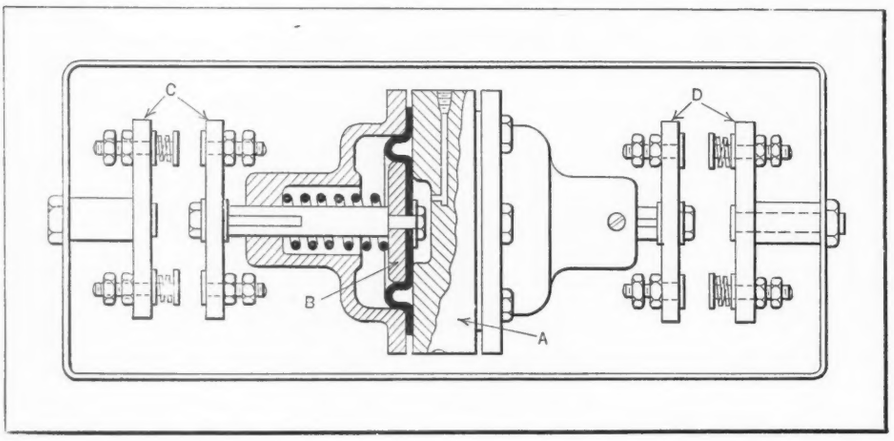


Fig. 7. Air-operated Switch that Operates Motor in Both Forward and Reverse Directions

instead of two sections. This band is split at the back and is connected to two levers, the opposite ends of which are actuated by rubber diaphragms in cylinder *A*. When the diaphragms are pushed up and down, the two levers pull the brake lining tightly on the flange of the motor pulley. The brake and the motor are controlled from the front of the machine by a valve of the same design as that with which the previous machine was equipped.

Any desired tension is obtainable in the countershaft belt by regulating the height of the motor base through an adjustable plate against which the roller *B* bears. Various amounts of tension can be obtained in the driving belt by means of adjusting screws on each of the countershaft brackets, as indicated at *C*. To relieve the tension in the countershaft belt for shifting, air is admitted into cylinder *D*, which raises the motor base and swivels the countershaft downward. Equipment similar to that illustrated in Fig. 8 has also been applied to a turret lathe.

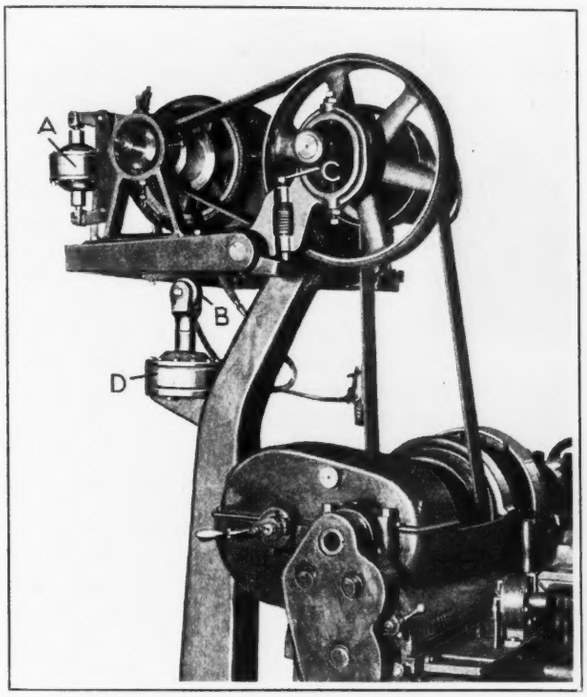


Fig. 8. Drive of a Second Engine Lathe in which the Air Brake Consists of a Single Split Band

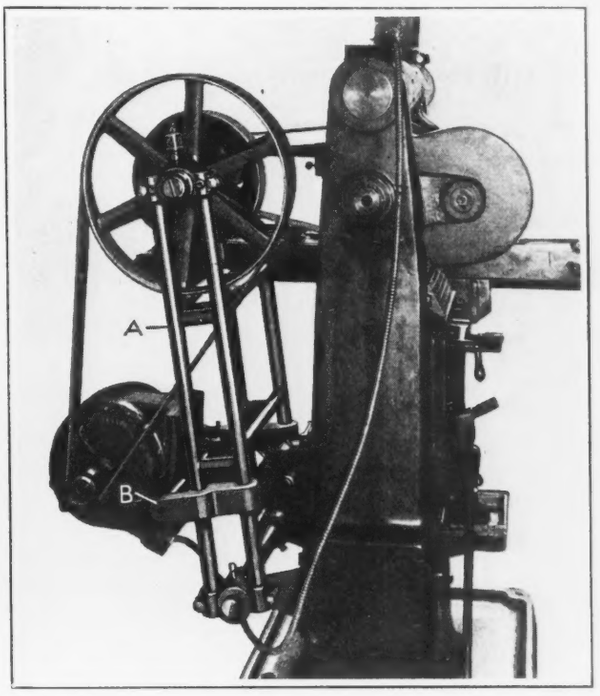


Fig. 9. Drive of a Milling Machine that Insures Uniform Tension in Driving and Countershaft Belts

Maintaining Uniform Tension in the Belts of a Milling Machine

Uniform tension is maintained in both the driving and countershaft belts of a milling machine by employing the equipment illustrated in Fig. 9. The motor and countershaft pulleys are mounted on a welded-steel frame *A*, which is hinged at the bottom of the machine column. The countershaft is fixed at the upper end of this frame, but the motor is free to swivel on a shaft held in two arms *B*. The weight of the motor thus keeps the driving belt under constant tension, while the weight of the motor, the countershaft unit, and frame *A* maintain a uniform tension in the countershaft belt.

When it is desired to shift the countershaft belt from one set of the pulley steps to another, the operator need merely pull frame *A* toward the machine to produce the necessary slackness in the belt. Since this photograph was taken, a rod has been provided that connects frame *A* to a crank-handle attached to the machine column. With this arrangement, it is only necessary to turn the handle to slacken the belt.

The operation of the squirrel-cage polyphase induction motor used on this machine is controlled by a drum switch mounted on the machine column. By means of this switch, the direction of rotation of the motor shaft can be instantly changed to suit right- and left-hand cutters.

The experience of the writer has been that, by maintaining the proper tension in the belt, short-center, flat-belt drives prove very efficient and make long belt life possible. In the examples given, the motor pulleys range from 3 to 4 inches in diameter and the countershaft pulleys up to 24 inches in diameter. The center distances between the pulleys vary from 18 inches to 2 feet. Belts used on these drives for years do not show any wear.

Obtaining Better Results in Hardening High-Speed Steel

By WILLIAM E. SNOW

The Service Rendered by High-Speed Steel Tools and Cutters Can be Greatly Improved by Following the Methods of Hardening Developed by the Makers and Large Users of This Material

First of Two Articles

THE methods of hardening high-speed steel employed at the present time by some of the large companies leave little to be desired. This is far from being the case, however, in most of the smaller shops. The writer's work as demonstrator and trouble-man for a large mill producing high-speed steel has kept him for fifteen years in daily contact with the hardening problems encountered by both large and small shops. This close association with practical hardening problems in all kinds of plants has given him an excellent opportunity to obtain reliable information on the methods that have given best results. The present article is based upon facts gathered during the experience outlined. It is presented with the object of assisting all plants to obtain maximum efficiency from high-speed steel tools and cutters.

Methods of Heating High-Speed Steel for Hardening

Three different means are used today for heating high-speed steel to the temperature required for hardening. These are the open forge, the gas furnace, and the electric furnace. The forge has many disadvantages for this class of work, and has gradually fallen out of use, although lathe and planer tools are still heated by this means in a number of small shops. The air blast from the blower decarburizes the steel to such an extent as to render it impossible to obtain satisfactory results in hardening milling cutters and other tools that cannot be ground all over after hardening. The intense heat required for such work burns out the fire rapidly, necessitating rebuilding after one or two tools have been hardened. The lack of temperature control also makes hardening a matter of guesswork, so that two tools seldom give the same service.

The gas furnace has none of the disadvantages and limitations of the forge. It gives a continuous uniform heat that can be easily and quickly regulated to any desired degree. The tool is not in direct contact with the fire, as it is in the case of the forge. Although air is present in the gas furnace, its decarburizing effect on the steel can be minimized by keeping the mixture slightly on the "gassy" side. Pyrometers used with gas furnaces enable the temperature to be regulated accurately, so that all guesswork is eliminated. Gas furnaces can be obtained in a variety of shapes and sizes to suit requirements.

The heat in a gas furnace, though constant, is not necessarily the same in all parts of the furnace. In most gas furnaces, particularly those of the larger sizes, so-called "cold spots" are to be found, usually along the sides, and in the case of long furnaces, at the ends of the firebox. These cold spots vary with the size and shape of the furnace, and the arrangement of the burners and baffles. The larger the furnace, the greater the chance for the presence of such spots. For this reason, as well as

William E. Snow was born at Cambridge, Mass., in 1876, and received his education at Chauncey Hall and at the Rhode Island Technical School, where he took a mechanical engineering course. His early practical experience was with the Stone & Webster Engineering Corporation; later he was employed by the General Electric Co. on steam turbine developments. Then he became head of the steam turbine department of the B. F. Sturtevant Co. He is the inventor and patentee of a number of steam turbine improvements. After his association with the Sturtevant company, he studied practical steel making and became New England sales manager of the Vanadium Alloy Steels Co. He was connected with that company for ten years, after which he went with the Midvale-Cambria Co. as sales engineer, remaining with the latter company until it was taken over by the Bethlehem Steel Co. Since that time he has served largely in an advisory capacity as engineer, dealing with production problems as related to tool and alloy steels. Thus he is well qualified to write on the heat-treatment of steel.

for fuel economy, it is advisable to use a furnace of no larger size than necessary for the convenient handling of the work. The close attention required in hardening high-speed steel seldom permits more than one piece of work to be handled at a time.

The Electric Furnace and the Reasons for its Use

The electric furnace has several important advantages in hardening high-speed steel. The heat is produced by numerous small heating elements, equally spaced around the firebox to insure an even temperature in all parts of the furnace. The maximum temperature variation in small electric furnaces is less than 5 degrees, while in the larger and longer ones it does not exceed 10 degrees from one end of the furnace to the other. It does not require hand-regulation of the heat, the temperature being controlled automatically.

In operating the electric furnace, it is only necessary to set the regulating hand on the pyrometer to any required temperature, and the furnace does the rest by thermostatic control. The even distribution of heat permits the work to be placed in any part of the furnace, regardless of size, with the assurance of uniform results. No air is introduced into the furnace during the process of heating to decarburize the steel, and the tools come out in the cleanest possible condition, with the thin cutting edges sharp and unimpaired.

How the Proper Hardened Condition is Obtained

The object of heat-treating high-speed steel is to put it into martensitic or the commonly known "hardened" condition. Martensite is a constituent of steel resulting from very rapid cooling from a temperature above the critical point. It is the first, and hardest, of the progressive series known as martensite, troostite, sorbite, and pearlite, and is the only constituent—with the exception of austenite—producing sufficient hardness for cutting tools.

Austenite is a solid crystalline solution of iron carbide and iron, stable above the critical range only. If an instantaneous quench from a temperature above the critical point were possible, the product would undoubtedly be austenite—that rare constituent whose occasional presence in steel may account for the remarkable performance of certain "freak" tools sometimes encountered.

As austenite is rarely produced in commercial work, martensite must be depended upon for practical purposes. Even martensite in pure form occurs infrequently, usually being mixed with more or less troostite or sorbite, the constituents representing the next degree of softness. It is obvious that very careful treatment of the steel is necessary to produce the condition that will result in maximum tool efficiency.

Equipment for Hardening High-Speed Steel

The best equipment for hardening high-speed steel consists of a hardening furnace capable of maintaining a temperature of 2400 to 2450 degrees F., and preferably no larger than is necessary for handling the work one piece at a time; a preheating furnace capable of maintaining a temperature of 1800 degrees F., and of sufficient size to hold a number of pieces of the work; and a tempering (drawing) furnace capable of maintaining a temperature of 850 to 1300 degrees F. All these furnaces must be pyrometer-equipped, and a water-cooled tank of quenching oil is required. Many shops have but two furnaces, one for carbon steel and one for high-speed steel. In such shops, the tempering can be done in the furnace used for hardening carbon steel after the preheating is finished and the steel has been removed for hardening.

Importance of Correct Quenching

For best results, high-speed steel should be quenched from a "rising" heat. The steel should never be "soaked," even for a short time at the quenching temperature, as this tends to coarsen the cell structure and lower the efficiency of the tool. By operating the hardening furnace at a temperature of 50 to 100 degrees or more above the quenching heat of the steel, the quenching can be done on a rising temperature. The steel is simply removed at the proper moment before it attains the full heat of the furnace. It should be noted here that the pyrometer used in connection with this method of hardening serves to determine the temperature of the furnace and not the temperature of the steel, the proper quenching heat for which is determined by the appearance of certain physical characteristics under the action of the heat. These characteristics will be explained in the succeeding article, to be published in April MACHINERY, which deals with the actual hardening operations.

The tool to be hardened must be brought to the hardening temperature as quickly as possible, because the time required in obtaining the final heat has an appreciable effect on the tool. Thus the steel should be preheated to the highest practical temperature, and "soaked" well at this temperature to insure thorough and even heat penetration throughout the piece. If this soaking is carried on at too high a temperature, the result is injurious to the steel. The practical limit of safety in this respect seems to be a temperature of from 1800 to 1850 degrees F.

Effect of Forging on High-Speed Steel

Steel, as fabricated at the mill, is worked under the hammers and through the rolls at a high heat, as this not only favors production, but also lessens the liability of forming cracks and seams, which are produced if the steel is worked too cold. As the forging of a tool is simply a repetition of the original process at the mill, the same care should be used to keep the steel up to the full forging heat while being worked. A hammer blow should never be struck after the steel has cooled below the safety point. Even a light blow may cause harm when the steel is in this condition.

As heavy hammering, while hot, increases the density of the steel, the trip-hammer should be used as far as practicable in forging a tool. In this respect, it is interesting to note that drop-forged disks give better results for milling cutters than rounds cut from regular bar stock.

Care should be taken not to heat the steel for forging too abruptly. In many shops, the steel racks are in unheated parts of the building or in sheds out of doors, so that in winter the steel is extremely cold when brought into the blacksmiths' shop. If put directly into the hot forge fire, it is likely to develop cracks which will show up later in the finished tool. It should, therefore, be warmed gradually before heating for forging.

All steel, as it comes from the rolls at the mill, is in a poor physical condition, due to locked-in hammer and rolling strains. To avoid the possibility of working troubles resulting from this condition, it is advisable to obtain the steel in the annealed state. As forging results in the same condition, it is equally advisable to anneal the forged tools before they are heat-treated. A "quick" anneal will serve this purpose, and may be accomplished by reheating the tool to the forging heat, afterward burying it in a box of lime or ashes and allowing it to cool off gradually. This will require only an hour or so, after which the tool may be removed for hardening. If much grinding is required to give the desired shape, it is better that the grinding be done with the tool in the soft condition than after it is hardened.

Preheating to Avoid Internal Strains

The heating up of cold steel to furnace temperature should be done very gradually and carefully. This applies especially to milling cutters, taps, and other tools having thin teeth and thick bodies, and to forming tools of irregular shape and section. The thinner sections of such tools absorb heat more readily than the thicker sections and the unequal expansion that results sets up enormous strains in the steel when it is heated too quickly, causing cracks which become apparent after quenching. Probably more tools are ruined from this one cause than all others put together. Lathe and planer tools of even section should also be handled carefully in this respect.

The cold steel should first be warmed up by placing it on top of the furnace or some other suitable warm place. Then it can be put in a furnace at the extreme front, leaving the door open to allow of gradual heating. The piece should be turned end for end frequently to insure even penetration of the heat. As the steel takes on heat, it may be moved gradually further back into the furnace and the process repeated with other pieces until all are in the furnace or the furnace is full. The furnace door can then be closed. The furnace should be kept at a temperature of 1800 degrees F., and the pieces allowed to "soak" until they are at an even heat throughout their varying sections. They are then ready for hardening, as will be described in the next article.

Tantalum Used as a Binder for Tungsten Carbide

Tungsten carbide, as it was first available commercially, consisted of small particles of tungsten carbide cemented together by an alloy of cobalt, tungsten, and carbon. It was found that in cutting steel, a chip cavity or crater frequently developed directly behind the cutting edge, especially when cutting soft steel. The crater materially shortened the cutting life of the tools, as it necessitated removing large portions of the hard alloy when regrinding. The formation of these craters is due to the "affinity" of the chips for the cemented carbide material and also to the relatively high heat conductivity of the cutting tip, causing undue heating.

In the search for a hard cemented cutting alloy that would cut steel without developing cavities or craters, tantalum carbide has been substituted for tungsten carbide. The tantalum-carbide particles are cemented together by an alloy of tantalum, carbon, tungsten, and cobalt. Tantalum-carbide tips have a slightly lower heat conductivity than tips of tungsten carbide, so that the temperature of the tantalum-carbide tool itself is less during the cutting. The heat tends to remain in the chips, and is conducted away by them. The alloy binder, because of the tantalum which it contains, has a slimy or greasy consistency similar to that of high-chromium steels. For this reason, the binder has a tendency to overcome the action of the chips on the cutting tip.

In experiments made with tantalum carbide, the Firth-Sterling Steel Co., McKeesport, Pa., has found that this material possesses a brittleness that tends to shorten the life of the cutting tip. This led to the "insulation-lubrication theory" of producing hard cemented cutting alloys, which is now being followed by this company. In these alloys, tungsten-carbide particles are bound by an alloy containing tantalum, tungsten, carbon, and cobalt. These new alloys have demonstrated that the cementing of strong tungsten-carbide particles by an alloy that reduces the heat conductivity is a step toward lengthening the life of tools made from cemented cutting alloys.

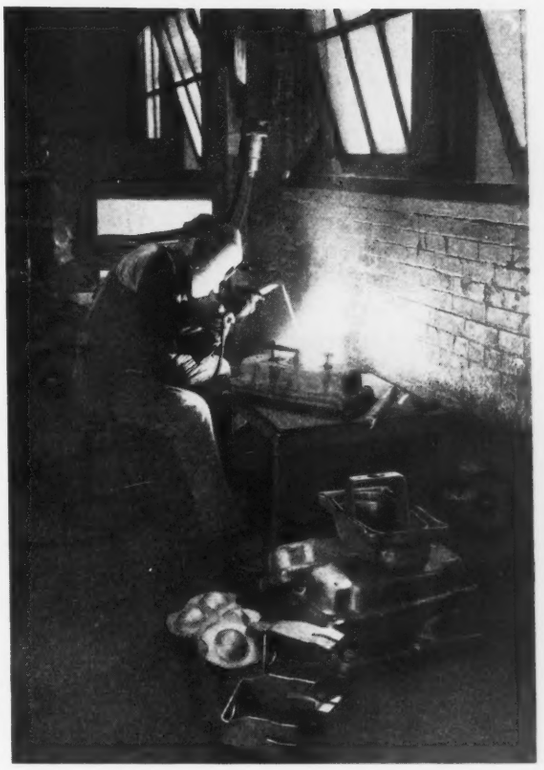
* * *

Corrosion due to acids and caustics used in many industries can be reduced by using alloy cast iron containing nickel, copper, and chromium for pipes, pumps, and fittings. Lower operating costs and continuity of operation are thereby assured.

Welding Non-Magnetic Steel Alloys

Producing Improved Electrical Circuit-Breakers by Arc-Welding Nickel - Manganese Steel Tops and Parts to Mild Steel Sides

By PAUL ORR, Supervisor of Welding
Westinghouse Electric & Mfg. Co.



IN the manufacture of oil circuit-breaker tanks, it is desirable to have the tops and certain parts made of a non-magnetic metal in order to keep the surrounding steel at a minimum temperature when heavy currents pass through the breaker. The nickel-manganese steel alloy tops now being applied to circuit-breakers possess the non-magnetic property so desirable for this purpose. The arc-welding of these non-magnetic tops to the mild steel sides of the breakers results in a strong oil-tight construction that permits larger capacities to be built into a given space.

One of these fabricated non-magnetic tops that has been completely welded is shown in Fig. 1 undergoing an oil pressure test at 300 pounds per square inch. This top is 32 inches in diameter. The heavy rim is rolled from 3- by 3-inch mild steel stock and arc-welded with a mild steel welding rod. The dome is made of a non-magnetic steel of the following composition, which is now commercially available: Carbon, 0.25 to 0.40 per cent; manganese, 6 to 8 per cent; and nickel, 10 to 12 per cent. This steel has a strength and physical characteristics similar to and somewhat better than mild steel. It can be cut with a gas torch, and while not so readily machineable as mild steel, is still a commercially machineable material when properly heat-treated.

In Fig. 2 is shown a type of circuit-breaker top having all parts made of non-magnetic material except the rim and one of the side plates on the small box-shaped member that protrudes from the dome. These non-magnetic domes are pressed to shape from 5/8-inch stock and are jig-welded to the mild steel rim. The outside weld is made first, and then the top is turned over and another weld is made on the inside. After this, the openings for the bushings and mechanism box are made with the cutting torch. The dome is next placed in the jig, with the rings and box parts firmly clamped in place for the final welding, which joins them to the dome.

The oil circuit-breaker shown in Fig. 3 has the part of the top that carries the studs pressed into an irregular shape. This part is of non-magnetic steel and has a heavy ampere capacity. The weld between the non-magnetic dome and the mild steel sides is a single-vee reinforced butt-weld with an additional layer of metal over the inside seam.

In the heading illustration, a welder is shown at work on still another type of breaker top. Some of the parts of this top that are ready to be welded are

PAUL ORR, supervisor of electric and gas welding at the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co., is responsible for the development and patenting of the positive-grip electrode-holder. This holder grips the electrode by cam action instead of by springs. Mr. Orr has also assisted in designing welded structural steel buildings, welded electrical machines, bedplates, and other fabricated apparatus. At present he is supervising the repair, by electric arc welding of large cast-iron bleeder turbine housings. He is also actively engaged in developing methods of welding stainless steel. He has been with the Westinghouse organization since 1918, working for the first four years on miscellaneous production and repair, and serving for the next three years as instructor in charge of the welding school. He has traveled extensively as a demonstrator and sales promoter of arc-welding equipment. Since 1926 he has been supervisor of welding and is recognized as an authority in this branch of the industry.

shown on the floor. The circuit-breaker being constructed is known as the insert type, as it is pressed from mild steel with an insert of non-magnetic material welded in the opening in the manner illustrated. This top is made of 3/8-inch material and the insert is open-butt-welded in place; that is, no scarfing or veeing is done at the joint, the insert being fitted with an opening of 1/8 to 3/16 inch all around and welded from both sides. The yoke shown across the bottom of the completed top is made of non-magnetic material and is welded to the mild steel top with a fillet type weld.

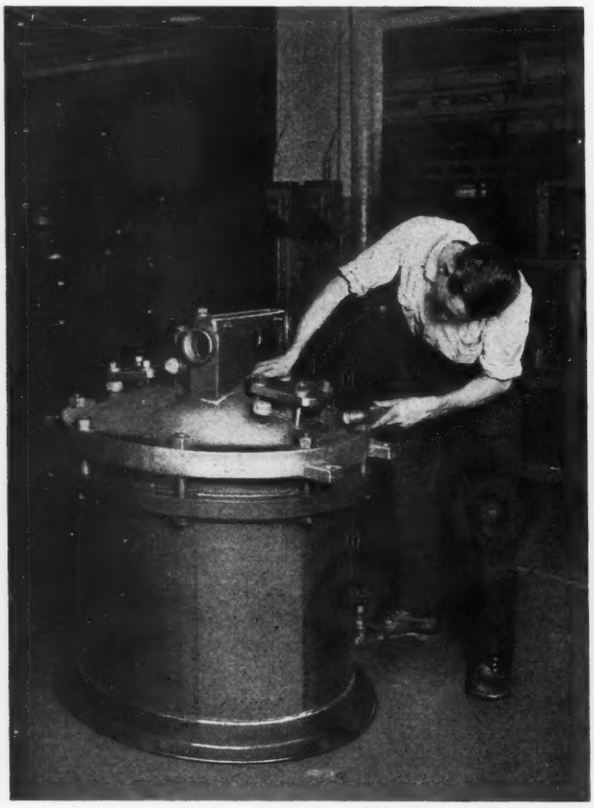


Fig. 1. Single-pole Circuit-breaker with Arc-welded Non-magnetic Steel Top, Undergoing Oil Pressure Test

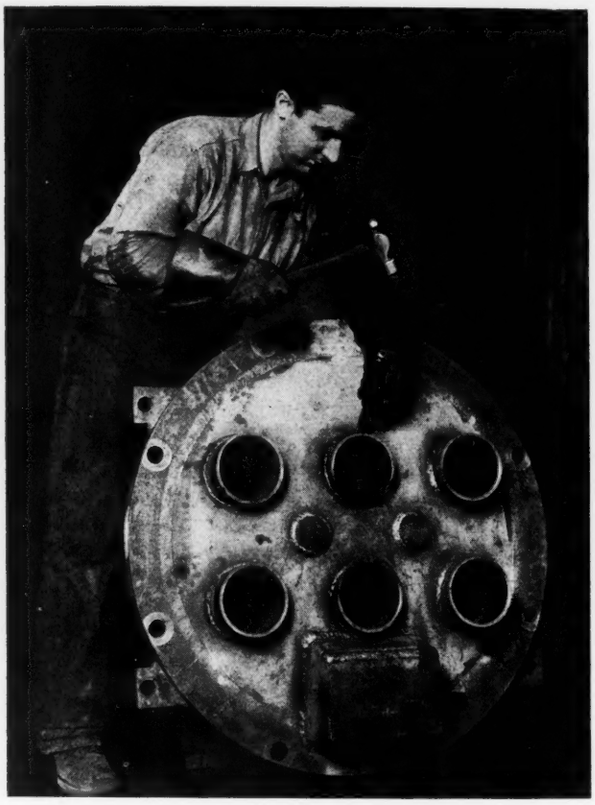
In welding non-magnetic steel, it is very important that the proper welding rod be used. The so-called 18-8 chromium-nickel alloy with low carbon content, when properly processed and heavily coated, generally makes the most satisfactory weld. Reversed polarity should be used with from 10 to 15 per cent more current for a given size rod than is used in welding mild steel.

Procedure in Welding Nickel-Manganese and Mild Steel with Chrome-Nickel Welding Metal

Most welded structures of the kind described have a mild steel on one side, a non-magnetic nickel-manganese steel on the other, and a chrome-nickel weld metal joint, although in some cases they may consist of two pieces of non-magnetic steel. A number of tests of the welds described show tensile strengths equal to or greater than good mild steel welds, but with better ductility. This construction, therefore, results in a very satisfactory product.

The work to be welded should be clean and free from oils, grease, and any foreign substances that may form gas pockets and leave pin-holes in the weld metal which would weaken it and cause it to leak. In developing structures of this kind that were to be adopted as standard designs, close co-operation was necessary between the welders and the designers of the structures. The materials involved differ greatly in composition and in electrical conductivity, and considerable study and experimentation were required to secure the satisfactory results obtained. Some important rules to follow in welding the manganese-nickel alloys are:

Fig. 2. Three-pole Circuit-breaker Top with Dome Plate and Other Parts of Arc-welded Non-magnetic Steel



1. Have the joint so designed that the metal being joined can be properly fused without using excessively high currents.
2. Have the work clean, and make sure it is held securely in place by jigs, clamps, or other means.
3. Have the welding current reversed; that is, have the work negative and the electrode positive.
4. Have one or two of the best mild steel welders available trained for this class of welding, giving

them time to develop the correct technique for this work.

5. Use welding wire having the following analysis: 17 to 19 per cent chromium; 7.50 to 10 per cent nickel; 0.06 to 0.15 per cent carbon; not over 0.60 per cent manganese; not over 0.40 per cent silicon; not over 0.025 per cent phosphorus, and not over 0.025 per cent sulphur.

6. Make sure that the welding wire is processed and properly coated, as this is very important in welding alloys of this kind.

Great care should be taken in welding chrome-nickel iron alloys known as 18-8, which contain approximately 18 per cent chromium, 8 per cent nickel, with carbon varying from 0.06 to 0.15 per cent, and with small percentages of manganese and silicon, as this material will expand 50 per cent more than ordinary steel when heated, and the heat conductivity is about 40 per cent that of steel. Owing to these conditions, this metal has a tendency to warp more than ordinary steel, and special care should be taken to provide suitable jigs and clamps for holding it rigidly in place while welding in order to prevent warpage. However, the same procedure is followed in welding this alloy as in welding nickel-manganese steel.

* * *

Spring collets with Stellite inserts have been found of great value in a Detroit automobile shop. C. C. Pendrell of the Haynes Stellite Co., in an address at the University of Detroit, mentioned that on one particular job on an automatic, solid hardened steel collets had to be discarded because of wear in about 14 hours, whereas Stellite collets averaged more than 1000 hours each, and some have been used as long as 2000 hours. The Stellite inserts are dovetailed into position and are reversible and replaceable.

* * *

New Moisture-Proof Gasket Material

A new moisture-proof gasket material, highly resistant to oil, has been brought out by the General Electric Co., Schenectady, N. Y. This material, which is known as "No. 1000 Compound," is recommended for applications where the primary purpose of the gasket is to exclude moisture, for which purpose it is said to have been found superior to cork. The material is a white, odorless, sulphur-free rubber compound, available both in sheets and molded shapes.

Steel Treaters Meet in New York

The New York Chapter of the American Society for Steel Treating met in New York, Monday evening, February 8. A. H. d'Arcambal, consulting metallurgist of the Pratt & Whitney Co., Hartford, Conn., and president of the Society, addressed the meeting on the subject of tool steels. The different classes of steels now used for tools were briefly discussed, and the heat-treatment required for each was outlined. The effect of different kinds of heat-treatments on steels of different compositions was shown by photomicrographs.

The chromium-plating of tools was also briefly touched upon. In this connection, it was brought out that by flash chromium-plating reamers and then lapping them to size, the durability of reamers may be greatly increased. The lapping removes the plate on the cutting edges, but it remains in the flutes and back of the cutting edge. For service where reamers would wear below size in three days, these chromium-plated reamers have given satisfactory results for three weeks.

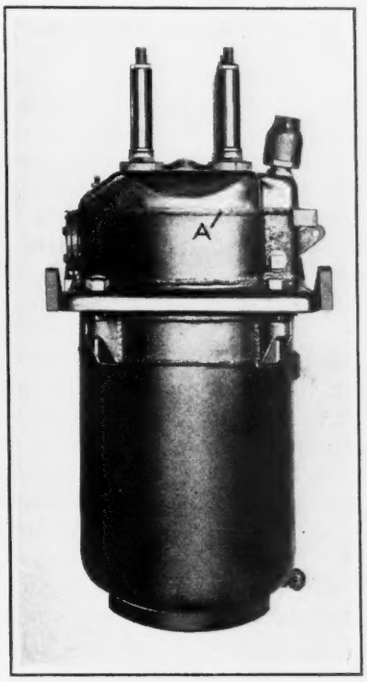


Fig. 3. Circuit-breaker with Non-magnetic Top Arc-welded to Sides at A

* * *

New Coated Welding Electrode

After months of extensive research, the Page Steel & Wire Co., Monessen, Pa., has developed a new type of coated electrode which gives very quiet operation with little or no sputter. One of the advantages claimed for the new electrode is that inasmuch as the arc is free-burning, the molten pool of metal can be readily observed and the amount of metal deposited accurately judged. Other advantages claimed are that the electrode can be bent to a reasonable degree without the coating peeling or falling off. The coating is moisture-proof and requires no baking before using.

* * *

Mileage Record for Railway Gearing

What is believed to be the mileage record for railway gearing is credited to a set of helical gears that have been in service on the Connellsville Division of the West Penn Railways since February, 1915. Up to September, 1931, when the set of gears was removed from service for exhibition purposes, it had operated over 886,000 car miles. The set is still suitable for further use and has been reinstated in service. The gears were made at the Nuttall Works of the Westinghouse Electric & Mfg. Co.

Diemaking Practice According to the Trend of the Times

Unusual Conditions Require Unusual Procedure — Methods Used for Year-In and Year-Out Production Jobs are not Applicable for Small-Lot Output

By WALTER WELLS

MUCH has been written about how to solve difficult problems in the design of dies and how to effect various economies in production. The aims have always been long life, accuracy, fewer operations, saving of stock, and the use of less skilled labor. All this is very desirable during normal times. But now, when practically the only dies that are being made are for short-run jobs—for assemblies that are mere try-outs to sound the market—it seems as though we will have to shelve the accepted theory of diemaking. In fact, we will have to make what amounts to a complete right-about face. The new criterion is: Will the die "knock out" 25,000 pieces? Is it cheap, very cheap?

Many high-class job shops have been hard hit, some have gone under completely. On the other hand, shops with lower standards seem to bear up surprisingly well under the present circumstances. It did not take them so long to catch on to the new trend in diemaking.

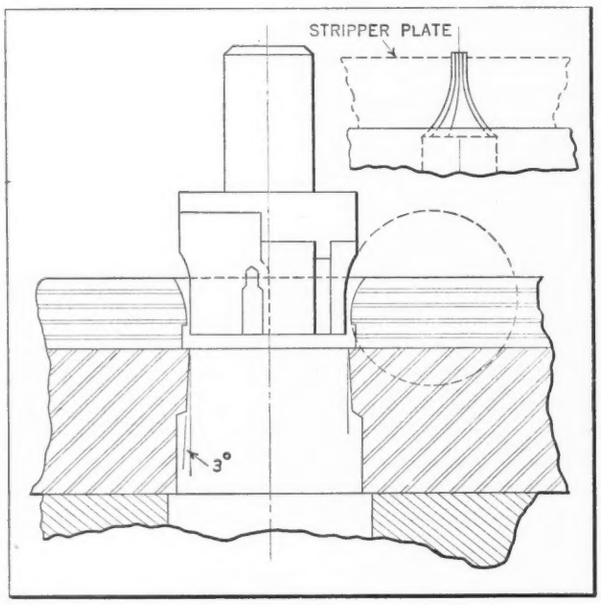
There is Such a Thing as Doing a Thing Too Well

It does not necessarily follow that a well equipped shop cannot compete during these times. In fact, the use of their good equipment in a new manner will give them the advantage. A sort of a reorganization has to take place. The toolmaker, at bench and machine, must literally be taught how to make dies the new way, the *cheap* way. He is not asked to adopt crude ways of working, but rather taught how drastic economies in labor can be effected. It is easy to understand, for example, that a first-class diemaker will display a conservative attitude when asked to change from the tried 1/2-degree to a 3-degree angle in die clearance!

The die shown in Fig. 1 is merely one of a lot of blanking dies that were made recently. It has no special features of design; but it was made, complete with stripper, stop, and bolster, in thirty-one hours. A glance at the illustration will reveal most of the modifications from standard die practice; note the 3-degree clearance angle and the generous counter-drilled relief at the bottom of the die-block. Also, the shearing on the punch extends back a bare 1/4 inch, leaving no more margin for resharpening than the makeshift nature of the die warrants. The stock happened to be 1/16 inch thick brass, but even on heavier materials, liberties may be taken.

Fig. 2 shows the essential features of the punch, stripper, die, and bolster clearance hole; for convenience, the punch and die are shown inverted. The relief in the die was made by drilling five holes about three-fifths of the way up. The chief concern in the lay-out was that the more critical indentations, such as at *a* and *b*, should be somewhat protected. Along the straight portions, as at *c*, or the projections, as at *d*, the most liberal relief was given. As for the clearance, every toolmaker knows how much more quickly the die can be drilled, taper-reamed, broached, chipped, hog-filed, and finish-filed to outline when a very generous degree of clearance is allowed below the shearing edges.

Fig. 1. Die Construction that Permits an Unusual Reduction in Costs by Departing from the Usual Design and Standards of Accuracy



The punch was milled with a No. 21 Woodruff cutter; a No. 7 cutter took care of the indentation at *e*. The holes at *f* were drilled before milling to save chipping and filing at this point. The bolster is simply hogged out by drilling two holes and chipping a flat.

It was mentioned previously that good equipment might be used in a new manner. Using a die milling machine to hog out the stripper may seem like "sacrilege," but it was done to advantage on this job and on many other jobs as well. It does not pay to fuss around on dies having narrow projections with a die miller—

these indentations have to be drilled out anyway; but it pays to mill out the stripper for the same die in this way. This is because no great accuracy is required in doing this. Owing to the nature of the stripping action, a liberal swing may be taken at outer points like *g*. Only at inner points like *h* and *i* must the cut be somewhat closer to the outline. At *j*, of course, the scrap is very narrow and care must be taken.

The cutter for milling the stripper, which is shown in the upper right-hand corner of Fig. 1, is a homemade affair. Quite a rapid feed may be taken with this. The tip will not break off, for the heavier portion has the most stock to cut and this reduces the feed sufficiently to safeguard the more slender portion. In the lower view, it will be seen that the top clearance on the stripper is in harmony with the scant shear on the punch.

Guide pillars and trigger stops are not used. Dowel-pins made of unhardened drill rod are employed, but it may shock an old-timer to learn that the pin-holes in the dies are not lapped. The pins are merely filed to fit, and the three lower members are held together by 3/8-inch cap-screws, a wrench being applied to screw them tight. There is no doubt that the dowels will be useless when the die has been taken apart several times, but the main point is that those "several times" will never occur with dies used only for short runs.

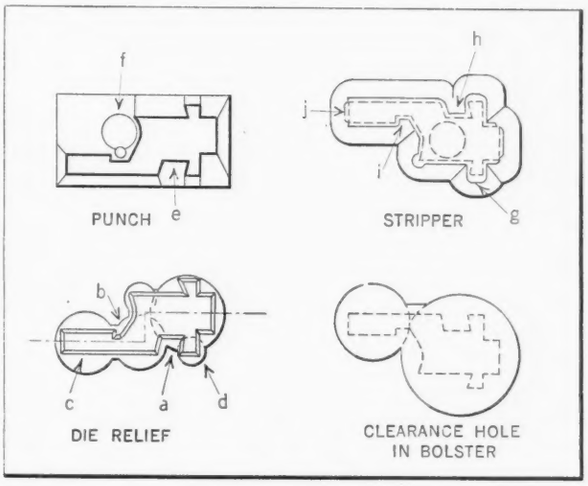


Fig. 2. Members of Die Shown in Fig. 1, Indicating the Generous Clearances that are Provided throughout

The New Methods Meet the Approval of Customers Today

Most important of all, the customers are thoroughly in accord with this trend in diemaking. They feel that such a development is to their interest at the present time. For instance, in the case of the die under discussion, a run of 10,000 pieces was blanked out satisfactorily. If there should be another run, it will be in the indefinite future. The die cost, it should be noted, was less than $50.

It would hardly do to allow the matter to rest at this point. Such makeshift methods are not the aim of American toolmaking. The time will come when we will be able to revert to sound and accurate diemaking; but, meanwhile, fine shop equipment remains idle unless it is used along the lines indicated.

The head of one small shop is quite certain that it does not pay to buy new equipment now. He endeavors to prove his point by citing his profits during the past year. He sticks to his principle quite rigidly, as one might note by glancing into his shop, which is in poor shape. His argument is, of course, a fallacy.

A Shop Will Not Lose its Reputation by Giving the Customer What He Needs

The writer has worked in both kinds of shops, and has spent a year in Soviet Russia, where the equipment is of the latest. He thoroughly appreciates modern machine tool engineering. The reason why some third-rate shops are making profits now is because they are more accustomed to makeshifts. As far as the first-class shops are concerned, the trouble is not a matter of overhead or anything like that, but simply a matter of psychology. The heads of these establishments seem to be afraid that they might lose their reputation if they deviated from established practice.

On the contrary, present conditions call for a great deal of flexibility in methods to meet competition. The ideas proposed for cutting diemaking time represent only one of the savings that can be effected. Machines must be brought into broader use; new divisions of labor must be organized; old shop traditions must be forgotten. The problem can be grappled with only by resorting to the most drastic measures.

I have no doubt that many an invention or new development could be tooled up if the die estimates were brought down within reach. Those shops that are flexible enough to meet this need will—instead of losing their reputation—be known for their resourcefulness.

* * *

The problems of international finance that seem so perplexing would be more readily understood if it were appreciated that nations cannot pay their obligations to one another in gold, except to a very small extent. Nations must pay their obligations to one another mainly in the products of labor. Hence, it is not so much a question of whether a nation will or can pay, as of whether the United States will or can afford to accept the payment. Germany, for example, can easily pay a large share of its obligations if other nations are willing to accept German goods in payment. The same is true of the Soviet Republics, whose main difficulty is to be permitted to pay.

How Purchasing Departments Can Aid in Reducing Costs

Mounting Selling Costs Can be Materially Reduced if the Purchasing Agent Will Deal with Salesmen as His Firm Wishes its Own Salesmen Dealt with

By C. B. COLE, President
Tool Equipment Sales Co. Chicago, Ill.

PURCHASING departments are necessary in large manufacturing plants, but it is evident that neither the purchasing agent nor his assistants can be expected to know all the details concerning the various items that they buy. It is, therefore, advantageous to have technical advisors who interview the salesmen in regard to specific lines. This saves the time of the tool supervisor, and at the same time gives the tool salesman a chance to explain his line.

In some organizations, the purchasing department absolutely shuts the door to any possible improvement in their manufacturing methods; and in other organizations, the purchasing department, when confronted with something out of the ordinary or a product that might appeal to them, sends the salesman to the tool supervisor or superintendent, as the case may be. This practice is wasteful of both the salesman's and the company's time and is an annoyance to the shop men, as it is not always possible for the tools or ideas to be used in their production. However, no organization should ever shut the door on possible means of improving their manufacturing methods. Therefore, some happy medium should be established to take advantage of the opportunities that might be presented by the tool salesman.

The time wasted by the tool salesman in calling on some of the large organizations, as well as the small ones, cannot be calculated. This waste of time can be largely eliminated by the cooperation of the purchasing department. No concern can purchase from every salesman that calls on them, but certainly more rapid interviews than are customary can be granted. Instead of letting the tool salesman sit on the "mourner's bench" for an hour or two, and then telling him there is nothing in his line of interest, he should be given an immediate interview —within five to fifteen minutes.

It often happens that some purchasing agent will have an old friend call on him and will spend an hour or more talking about his golf score, prohibition, or some other interesting subject, instead of business, ignoring the salesmen who are waiting. In many instances, a salesman calling on the purchasing agent will have a great number of subjects to cover, and this will involve considerable time. In this event, it would be a simple matter for the purchasing agent to ask the salesman to wait a few minutes until he disposes of some of the other men who are waiting.

Most of the progressive manufacturing plants are aware of the fact that unnecessary delay in granting interviews to salesmen has a bad reaction, and are very careful to instruct the person at the information desk to use every effort to see that salesmen are taken care of promptly and courteously. They realize that they have salesmen of their own and would like to have them meet with the same treatment.

Recently some of the manufacturing concerns have established definite hours for calling on the purchasing department. In some cases, these are from 9 A.M. to 3 P.M. on alternate days of the week. In other cases, signs are posted stating that purchasing agents can be interviewed on certain days of the week only; while in still other cases, the purchasing department can be seen only in the

C. B. Cole was born in Orange, N. J., in 1888. During his high school years, he started learning the toolmaker's trade. After graduating, he completed his practical experience in the experimental laboratory of Thomas A. Edison. At the same time, he attended evening technical schools in Newark, N. J., and continued his technical studies for several years afterward. During the war he was with Slocum-Avrim-Slocum Co., New York City, in charge of the toolroom and gage design. Later he was employed by the Wright-Martin Aeronautical Corporation as mechanical engineer and chief tool inspector in charge of all plants. In 1919 and 1920, he was Chicago district sales manager for the Union Twist Drill Co., Athol, Mass. In 1921, he became president of the Tool Equipment Sales Co. in Chicago. Mr. Cole is a member of the A. S. M. E., and was chairman of the Chicago Local Section in 1930-1931. He has written numerous articles for trade publications, and a text-book on tool design, which was published in 1929. He is also the inventor and patentee of a boring and grinding machine and of a boring head.

morning. One organization posted a sign stating that salesmen would be interviewed from 2 to 4 P.M.

Such practices increase sales costs tremendously. A salesman cannot always arrange his calls to be at plants on the day of the week specified or between the hours designated. On a Wednesday, he might call on a plant whose purchasing department could be interviewed between 10 and 12 A.M., and within a block there would be a plant that he must call on between 2 and 4 P.M. There might possibly be another plant nearby whose purchasing department could be interviewed on Thursday morning only, so he would be compelled to call there the following day. This means repetition of calls in the same neighborhood and much waste of time.

The writer wonders whether concerns who make rules of this kind appreciate the fact that *their* salesmen are going to be confronted with the same problem, and that the cost of selling *their* product will also be increased unnecessarily.

Selection, Training, and Compensation Plan for Minor Executives*

By GORDON LE FEBVRE, Consulting Engineer, Detroit, Mich.

One of the most important phases of industrial management is the selection and training of foremen, supervising assistants, time-study men, and tool designers, and their treatment through the various economic changes in the business cycle. The average foreman represents an investment of about five thousand dollars. Surely, then, we should give to his selection at least as much thought and effort as to the selection of a machine tool representing an equal outlay.

Many appointments are made by one executive without consulting any of his associates. Sometimes such appointments may be influenced by personal motives. Obviously we would have a better foundation on which to base our selection if a running record of the past performance of each prospect were kept. Performance records, however, should not be built up by one executive alone, but should represent the composite opinion of several responsible men.

An applicant should not be hired or promoted without being interviewed by one of the higher officers of the organization, preferably the general manager or president. Only a few minutes is required to explain the policies of the company and the duties the prospect is to assume.

The Training of Minor Executives is Not Given Sufficient Attention

The proper training of minor executives is quite often overlooked. Most men at the time of their appointment have had little experience in the handling of men or in the application of wage payment systems, and other problems that they will be called upon to handle. There are many plants headed by executives of the very highest caliber, where foremen have practically no knowledge of the fundamentals of their job. For example, when a foreman does not understand the operation of the wage payment system, how can he be expected to keep his men in a satisfied frame of mind?

Every minor executive should be given a course of training; this can be conducted at relatively little expense, either wholly or partly on the man's own time. It should embody at least an elementary course covering the wage payment system in use, the operation of the budget system, cost control, handling of men, elimination of waste and scrap, cleanliness, etc.

The more the foreman knows of the company's general methods and the functioning of other departments, the keener will be his interest in his own job. It is possible to educate a foreman to a point where his conception of the job is that he is manager of his department, buying materials from stock or other departments, and selling his finished product to the plant.

The Compensation of Minor Executives is Another Important Question

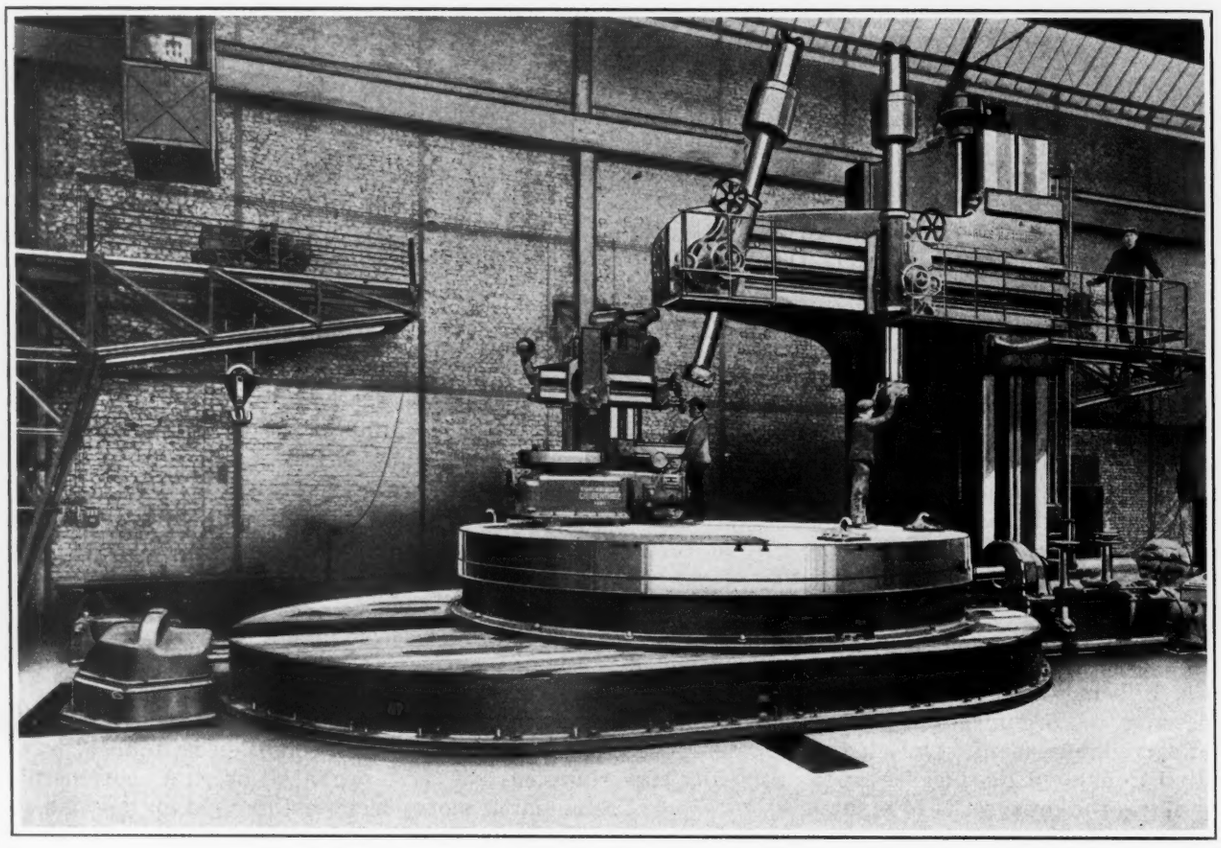
The compensation of the minor executive has been given even less consideration than either selection or training. Often his pay is small, even during good times, and he is likely to be laid off when business is bad. This condition is inimical to the interests of the organization. A considerable amount of money has been invested in this man and his worth should be recognized by the retention of his services through a depression, even if his pay must be temporarily reduced.

In a modern plant operating on a budget system, the following plan has been suggested for time-study men and similar employes. Place the salaries of these men on the basis of a nominal drawing account, to be determined by a survey of the local living conditions. The difference between the drawing account and the full salary would depend upon the company's sales. During a period of good business, the compensation would be much higher than the drawing account, but during periods of depression, the man would receive only his drawing account. Careful installation of such a system would permit a reasonable balance that would even up the economic peaks and valleys.

*Abstract of a paper presented before the Production Meeting of the Society of Automotive Engineers held in Detroit, Mich., January 28.

Notes and Comment on Engineering Topics

An unusually large machine of French manufacture—a single-upright boring and turning mill—designed by the Etablissements Charles Berthiez, Paris, has been built at the company's works at Lille. The diameter of the table is 20 feet, permitting work 26 feet in diameter to be turned. By a unique patented table displacement feature, the capacity of the machine can be increased to accommodate work 40 feet in diameter. The maximum height of work that can be machined is 12 feet; and the maximum weight, 100 tons. The machine weighs 207 tons. A 65-horsepower motor provides the main drive, and a 20-horsepower and two 10-horsepower motors operate the motions of the machine.



A Giant French Boring and Turning Mill of the Single-Upright Type, which has a Capacity for Work up to 40 Feet in Diameter

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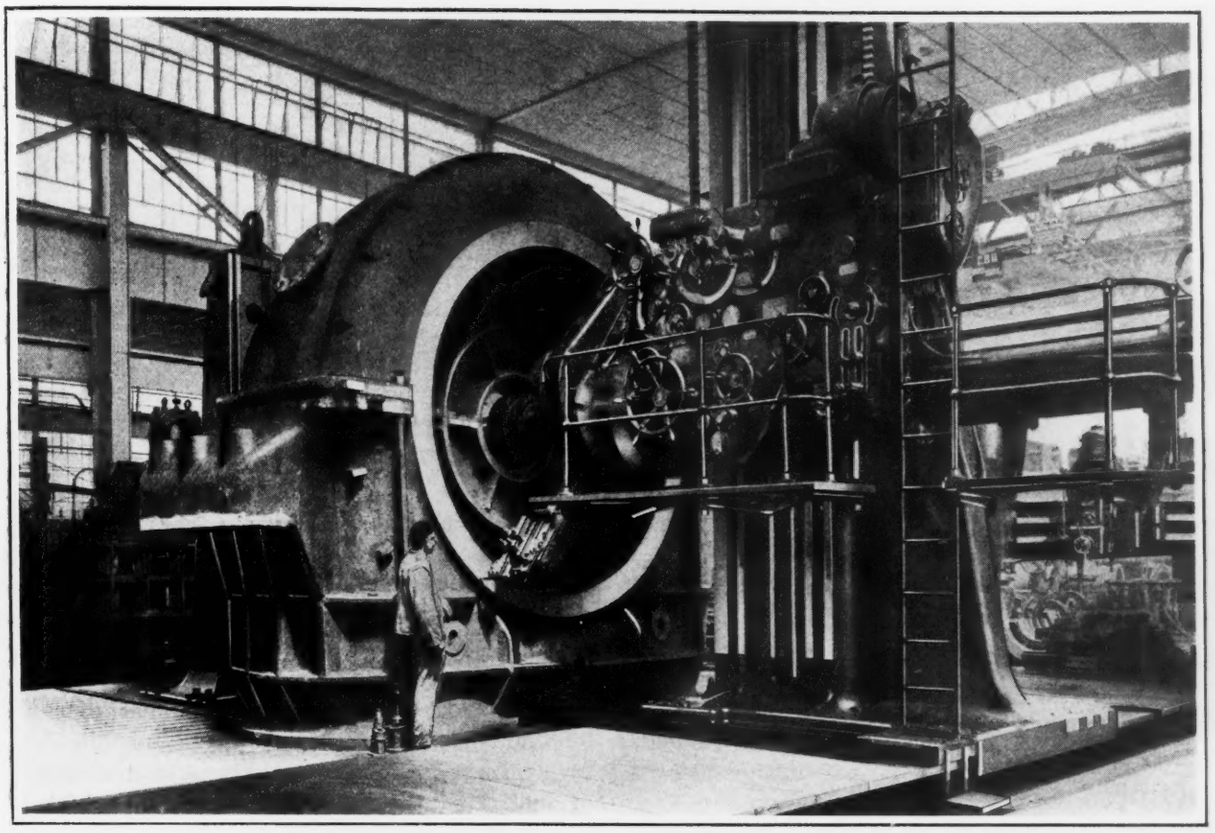
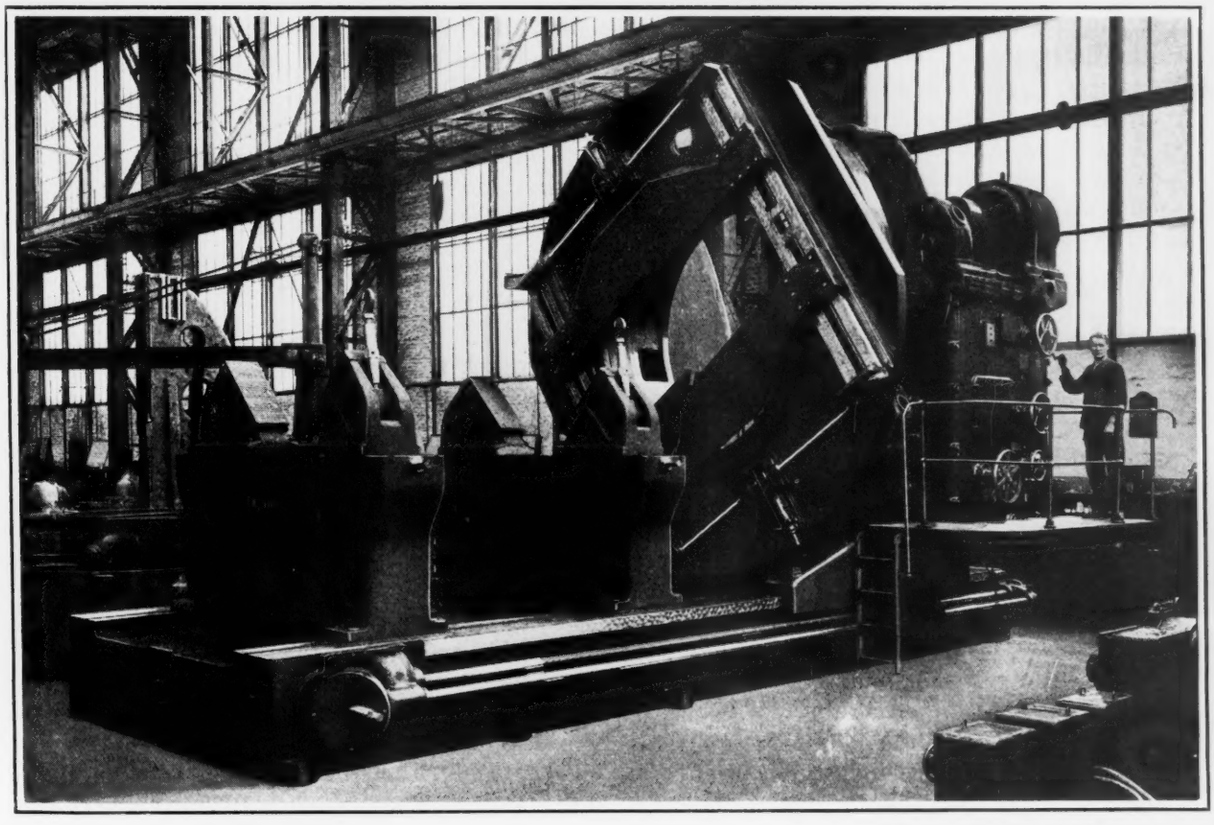
A laboratory to be known as the National Hydraulic Laboratory is being established at the Bureau of Standards, Washington, D. C., and will be ready for service during the current year. It will be equipped for conducting scientific research in hydraulics; making hydraulic tests of model structures; and testing and developing current meters and other hydraulic instruments.

A very large new tank shop, costing upward of a million dollars, has recently been completed at the Pittsfield Works of the General Electric Co. The new building is notable because it is constructed entirely of steel, eliminating brickwork, and is completely assembled by arc welding. The building is a one-story structure, 550 feet long by 150 feet wide, with a maximum height of 75 feet. The company lists the following as the principal advantages to be obtained from the type of construction employed for the building: Speed of erection; reduction in weight; same heat insulating value as an 8-inch brick wall; saving in cost of both material and labor; and complete salvage in case of remodeling.



(Above) A 200-ton Boring and Milling Machine Built by Schiess-Defries A. G., Dusseldorf, Germany, Machining a Steam Turbine Housing. The Maximum Height between Spindle and Floor Plate is 20 Feet

(Below) Crankpin Turning Machine, Also Built by Schiess-Defries, for Turning Marine-engine Crankshafts up to 24 Inches in Diameter. The Machine Has a 35-horsepower Motor and Weighs 48 Tons



EDITORIAL COMMENT

There are obviously two things that can be done to prevent the recurrence of serious business depressions. First, industry as a whole, and not merely a few large individual plants, must plan some kind of unemployment reserves to take care of its stable workers during periods of depression. These workers, as pointed out by James W. Hook, president of the Geometric Tool Co., in his paper read before the annual meeting of the American Society of Mechanical Engineers and in his article published four months ago in MACHINERY, are part of the industry, and industry cannot ignore them in times of depression.

This is not a matter of charity; it is a matter of good business. If the millions of stable industrial workers throughout the United States could feel sure of a steady income in bad times as well as in good, our business depressions would never become so severe as this one has been. Purchasing power would be maintained on a more even level, and the dip in the business curve would be nowhere nearly so great. The setting up of reserves for this purpose can be done as a voluntary measure on the part of industry. Group action, similar to that taken in the simplification programs sponsored by the Department of Commerce, is the suggested method.

Is the Business Cycle Entirely Beyond Our Control?

Another means of preventing serious depressions is for the Government—federal, state, and municipal—to plan public works well in advance, having all details ready for starting actual construction as soon as there is any evidence of falling off in employment. In this way, a more even employment curve would be assured.

As has been well said, the only cure for unemployment is employment. Careful long-range planning on the part of Government—as well as on the part of large industries—would assure that this remedy could be applied.

Although automobile production last year dropped to less than one-half of the record output in 1929, the industry retained its place as the largest industry in America. More than 4,000,000 wage earners were dependent directly or indirectly upon the industry for employment. According to Alfred H. Swayne, vice-president of the National Automobile Chamber of Commerce, the industry continued to be the largest single consumer of petroleum, lead, nickel, plate glass, and rubber, and one of the leading purchasers of iron and steel.

Few people recognize the magnitude of this industry, even when it runs at reduced capacity, as at present. Last year, for example, over 3,000,000 carloads of automotive freight were shipped over the railroads—equivalent to the total carloadings of the entire country for five weeks. The value of the total output of passenger cars and trucks, accessories, and service equipment was more than $2,100,000,000; and, in addition, $2,400,000,000 was expended on highway development and maintenance. What these figures mean in employment may easily be surmised.

A Great Industry That Maintains Its Leading Position

As a buyer of the products of the machinery and tool industries of the country, the automobile industry ranks first. It has been estimated that, directly or indirectly, the automobile accounts for 45 per cent of the small tools purchased, and for at least one-third of the machine tools manufactured.

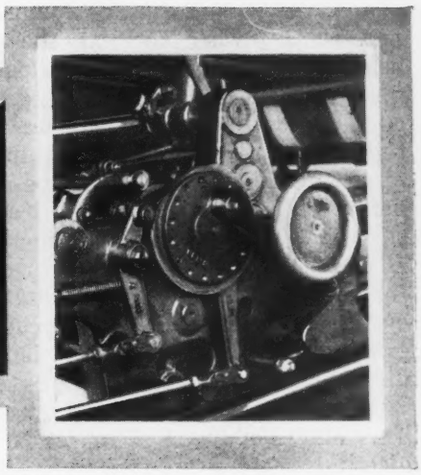
Success for the automotive industry means prosperity in practically all other mechanical fields. It is the one great producer of a consumer product that is truly the barometer of the country's business conditions. Whatever helps the automobile industry helps the country as a whole.

Recently we stepped into the office of a thoroughly irritated works manager. It did not take long before we found out the cause of the trouble. "Here am I," he said, "expected to turn out 1932 quality at 1932 costs with 1922 equipment. The directors who hold the purse strings insist that I reduce costs, but the product must be as good as or better than ever; and when I tell them that it cannot be done with out-of-date shop equipment, I am told that financial conditions do not warrant expenditures on machinery. What am I to do?"

Building a 1932 Product with 1922 Equipment

It is a little difficult to say what a man in this position is to do, but it is quite certain that if he is going to make his job worth while, he has to have the courage to go to the men who hold the purse strings and tell them that what they want done is a physical impossibility. He will have to say to them, plainly and clearly, "You cannot build a 1932 product at a 1932 price with 1922 equipment."

Ingenious Mechanical Movements



Ejecting Shells that Enter Hopper Chute Wrong Side Up

By J. E. FENNO

Among the many problems encountered in designing hoppers for feeding shells to dial presses is the delivering of each shell to the dial right side up. This is accomplished in one plant by means of the device shown in Fig. 1. The device is attached to the table of the press at the dial end of the chute, and is equipped with a vertical plunger for keeping those shells that have their open sides up in the chute. Another plunger ejects the shells that have their closed side up from the chute.

A screw shell *A* is shown at the end of the chute *B*. This section of the chute is adjacent to the dial (not shown) and is secured in the bracket *C*; the bracket, in turn, is fastened to the side of the press table. Slide *D*, equipped with a spring-actuated ejecting plunger *E*, is mounted in bracket *C*, and is given a reciprocating movement by means of the bell-lever *F*. This lever is oscillated by a link on the arm *G*, which is bolted to the press ram.

A vertical sleeve *H*, also secured in this arm, supports the spring-actuated plunger *J*. This plunger serves to prevent those shells that have their open sides up from being ejected from the chute. For example, the shell *A* is shown with its open side up; now, as the press ram descends, plunger *J* enters and bottoms in the shell. As the ram continues to descend, the plunger remains stationary; in the meantime, the slide *D* has advanced toward the left, forcing plunger *E* against the side of the shell. Continued downward movement of the ram will merely result in both plungers *J* and *E* collapsing into their holding members. Thus, plunger *J* acts as a lock, preventing plunger *E* from forcing the shell out of the chute.

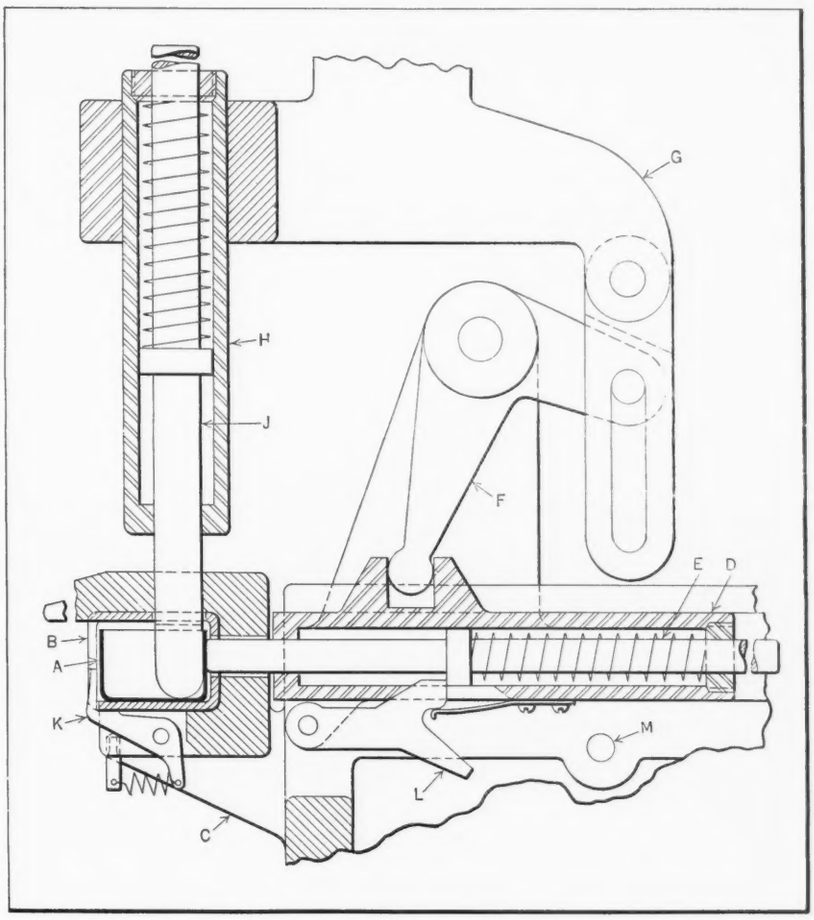


Fig. 1. Device for Ejecting Shells from Hopper Chute which Enter Chute Closed Side Up

Just before slide *D* has completed its movement toward the left, the latch *L* snaps into place behind the shoulder on plunger *E*, locking this plunger to the slide. Consequently, when the slide is returned toward the right, the pressure of plunger *E* on the shell will be released before the vertical plunger *J* leaves the shell. If this provision for locking plunger *E* were not made, the shell would be forced from the side of the chute. However, just before slide *D* has reached its extreme position at the right, latch *L* is disengaged from the plunger by coming in contact with the stationary pin *M*. This allows plunger *E* to return to its ejecting position in the slide. At this time, however, both plungers are out of the chute; hence the shell is free to enter the dial.

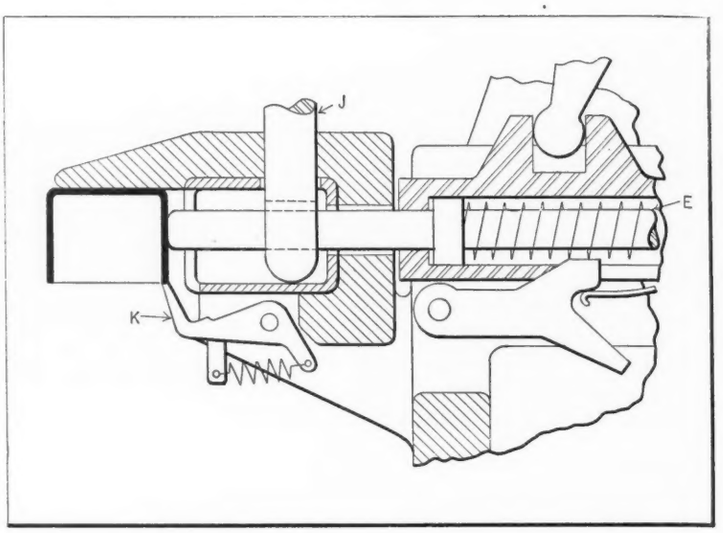


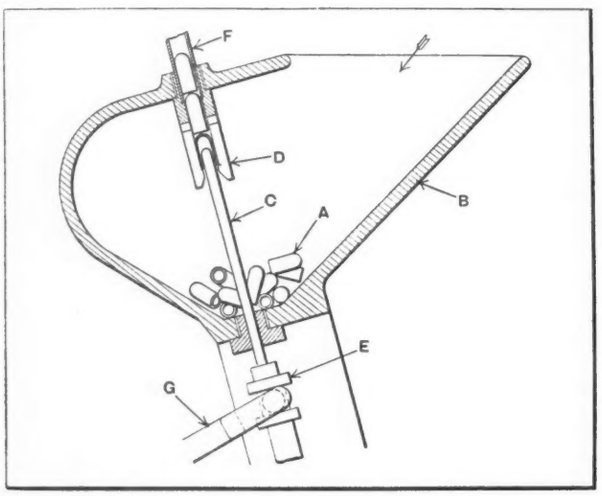
Fig. 2. Device Shown in Fig. 1 in the Act of Ejecting a Shell from the Chute

When a shell enters the chute with its closed side up, it comes into position under plunger *J*, which, in this case, rests on top of the shell. Then, when plunger *E* moves toward the left, the shell will be pushed out of the chute, as shown in Fig. 2. During the ejecting process, the vertical plunger merely drops off the edge of the shell and to the bottom of the chute. This plunger is forked to allow it to straddle plunger *E*.

It will also be noted that a guide rail *K* is provided to retain the shells in the chute while the ejecting device is inoperative. This rail is spring-actuated to allow it to return to its normal position as shown in Fig. 1. The ejected shells drop on a belt conveyor and are returned to the hopper.

Device for Transferring Shells from Press to Press

When two or more presses are employed in successive operations on closed-end shells, the automatic transfer of the shells from press to press may be accomplished by means of the hopper feeding device shown in the illustration.



Shells Ejected into a Hopper from One Press are Forced Through a Tube to the Next Press by a Reciprocating Plunger

A hopper *B* is located beneath the ejecting station of each press except that used for the final operation. As the shells *A* drop from the press, they accumulate around the rod *C*, the upper end of which has a diameter slightly less than the inside diameter of the shell. This rod is given a reciprocating movement by the forked lever *G* which engages the rod at *E*. The required movement is imparted to lever *G* by some member of the press or by a separate drive.

During its reciprocating movement, the end of the rod passes up and down through the shells, and if a shell is positioned correctly it will seat itself over the top of the rod. Then as the rod moves upward, the shell is pushed into tube *F*, and on the return stroke is stripped from the rod by the spring fingers *D*. The upper end (not shown) of tube *F* is connected to a feeding mechanism on the next press so that the shells are continually being fed to this press without being touched by hand.

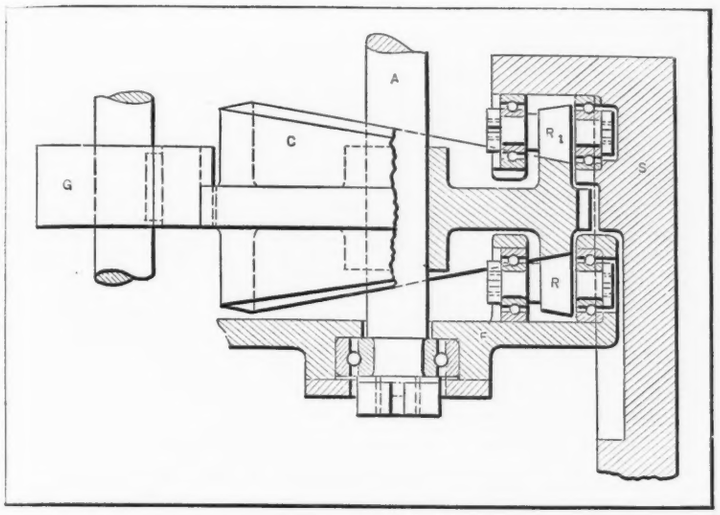
J. R. C.

[In this, as in most types of hoppers, the question of work jamming must be considered. In the present case, it is suggested that the rod *C* be backed up by a spring to prevent damage to the mechanism should a shell not seat itself properly on the end of the rod.—EDITOR]

Double-Faced Cam for Reducing Side Thrust

By J. S. BEGGS

The cam for operating the slide of a certain machine required a rapid rise without excessive side thrust. To meet this requirement, a double-faced cam was used (see accompanying illustration). Each face or edge of this cam *C* has a rise



Double-faced Cam which Moves Driven Slide a Distance Equal to Sum of Leads of Both Faces

equal to one-half the total rise required. The cam has a sliding fit on shaft *A*, and it is revolved by the driving gear *G* which meshes with gear teeth extending around the center of the cam.

As the cam rotates it rises, owing to the fact that it rests on a roller *R*, which is supported by the machine frame *F* and remains stationary except for rotation about its own axis. Bearing against the top face of the cam is another roller R_1, which is supported by slide *S;* this slide is the one that is operated by the cam. It will be evident that when the cam makes one revolution, slide *S* moves a distance equal to the sum of the leads of both cam faces, but roller R_1 and the slide take the thrust of only one cam face.

Varying the Cam Dwell with Two Adjustable Follower Rolls

By R. H. KASPER

An increase in the variety of products manufactured in one plant made it necessary to alter some of the wire-forming machines so that the dwelling periods of their slides could be varied. To do this, instead of employing one follower roll for each slide, two adjustable rolls were used, as shown in the illustration. The two dwelling periods of the slides can thus be varied to suit requirements. The cam, indicated at *A*, is secured to the driving shaft and engages both rolls *B* and *C*. The rolls are mounted on flanged bushings and secured to slide *D* by studs. They can be adjusted to any position along the curved T-slot *E*.

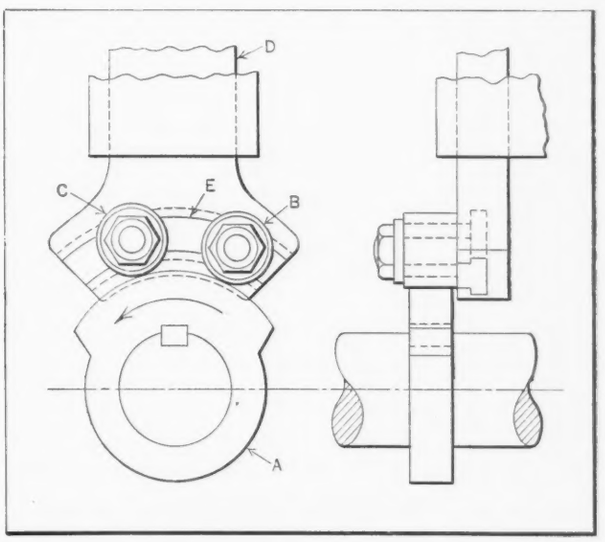
The amount of dwell and the timing of the rise and fall of the slide depend upon the distance between the two rolls and their location along the T-slot. For instance, if the slide were required to dwell longer in its upper position, the distance between the rolls would be increased. On the other hand, if the dwelling time in the upper position was to be decreased, the rolls would be brought closer together. The time at which the rise and fall of the slide occurs may be varied by adjusting the rolls along the T-slot without changing their center distance.

* * *

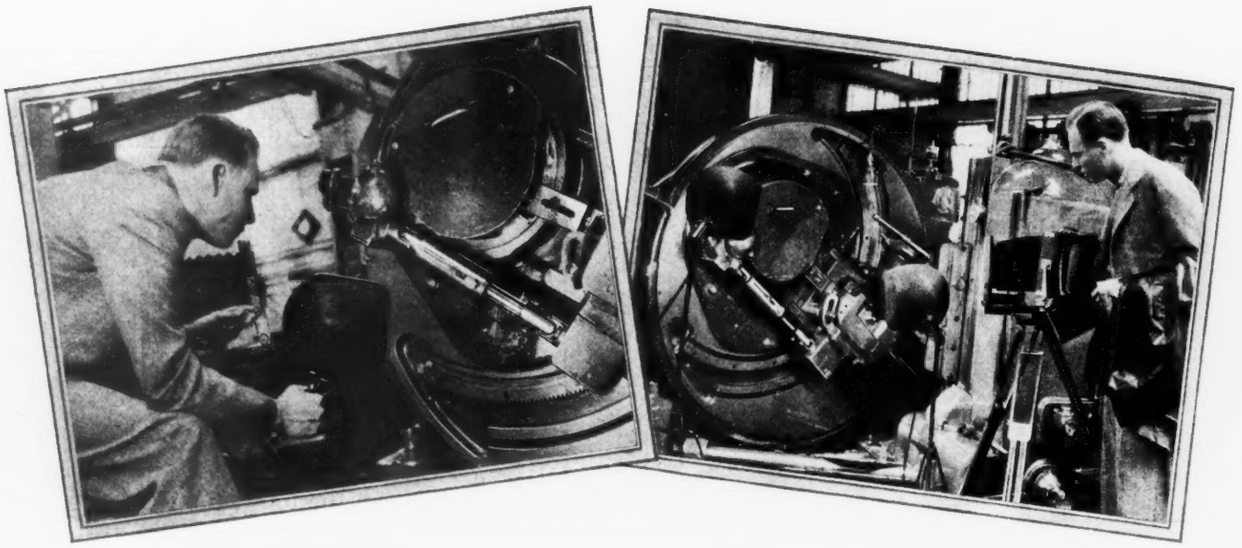
An instrument, somewhat like the seismograph, has been developed in the general engineering laboratory of the General Electric Co. for the measurement of vibrations in steam turbines or other machinery to which the instrument is attached. Within its case, which is bolted to the machine, there is suspended a block of lead. Two tension springs on the top and four springs on each side of the weight hold it in position. The outside shell of the detector vibrates at the same period as the machine to which it is attached, but the lead weight, because of its mass and low natural frequency, remains fixed in space.

In the lead weight on opposite sides, are embedded two coils. In front of each coil is an adjustable piece of magnetic steel, fastened to the outer shell. The coils in the weight are energized by 500-cycle alternating current, and the air gaps between the coils and pieces of magnetic steel are adjusted so that the two coils are electrically balanced, the amount of current passing through the coils depending on the distance of the steel pieces from them.

Vibrations of the machinery to which the detector is attached cause a swaying of the outer shell of the instrument and a variation in the distances between the coils and the magnetic pieces. These differences cause a variation in the flow of the current which is recorded on the indicating instrument.



The Dwelling Period and Timing of This Cam can be Varied by Simply Changing the Positions of the Two Follower Rolls



Better Machine Shop Photographs

By WILLIAM E. BARR

IN the first installment of this series of articles, published in February MACHINERY, the importance of an understanding on the part of shop managers and engineers of a few fundamental principles of machine photography was emphasized. The reasons why machinery photographs are difficult to make were outlined, and the preparations that can be made in the shop to aid the photographer were pointed out. In the present article the subjects of selecting lens equipment, focussing, and lighting will be dealt with.

The fundamentals of making a good record type photograph of machinery, or anything else, include:

1. The selection of a viewpoint that will depict the subject with the greatest amount of emphasis on the desired points.
2. The selection of proper lens equipment.
3. A plentiful supply of light, handled in a manner that will produce the most effective picture for the purpose.
4. The use of a film that will most accurately record the subject to be photographed.

Fig. 1. Photograph that was Distorted by Using a Lens of too Short Focal Length at Close Range. Notice Elongation of Gear Teeth as Contrasted with Fig. 2

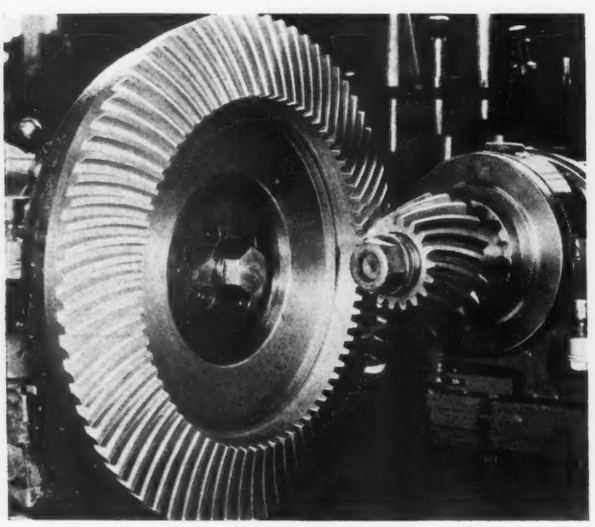
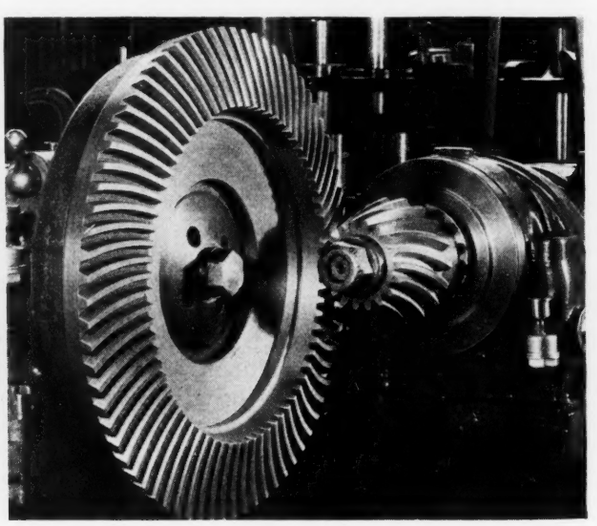


Fig. 2. Proper Perspective has been Obtained in This Photograph by Using a Long-focus Lens at a Greater Distance from the Subject being Photographed



There are subjects that permit some deviation from straight and narrow photographic practice without great loss of quality, but machinery is not one of them. The very physical aspects of machinery call for a strict adherence to accuracy.

Selecting the Viewpoint

The viewpoint is dependent upon what is to be pictorially stressed and what restrictions are imposed by conditions in the shop. Extreme conditions often demand views of machinery from unconventional positions. If such is the case, every vantage point should be thoroughly explored. For instance, the control cabin of a traveling crane may provide a convenient "high point." Many photographers are equipped with extra-length tripods for working from a point at a reasonable elevation. In any case, the engineer should accompany the photographer to insure the best viewpoints.

Aside from picturing a machine from a certain viewpoint, the photographer is interested in placing his camera in such a position that he will get the proper perspective. Perspective is determined by the point of view, and the point of view has a direct bearing on the focal length of the lens required.

The focal length of camera lenses is the same as the focal power of opera and field glasses. A camera lens of 12-inch focus, for instance, gives an image twice the size of that produced by a 6-inch lens with the camera at a given point. Therefore, when a 12-inch lens is used twenty-four feet from a machine, the size of the image on the film or plate is the same as when a 6-inch lens is used twelve feet from the machine.

Since the perspective is more pleasing as the distance from the subject to the camera increases, it is advantageous to use a lens of long focus and work at a distance commensurate with the focal length. For machine photography, a lens having a focal length equal to twice the diagonal of the plate gives a truthful and pleasing perspective. For example, if the camera size is 5 by 7 inches, a suitable focal length is 16 1/2 inches or thereabouts.

An example of poor and good perspective is shown in Figs. 1 and 2. The photograph reproduced in Fig. 1 was made on a 5- by 7-inch film with a lens of 8-inch focal length. It will be noticed that the gear teeth in the foreground are disproportionately long. Fig. 2 shows the same subject photographed with an 18-inch lens; in this case there is no distortion.

Since shop pictures are often made in congested areas, it is not uncommon for the photographer to be compelled to work at extremely close range to avoid including supports or other objectionable features in the picture. Some pictures must be taken so close to the subject that a long-focus lens is out of the question, and the forced viewpoint may even be too close for a lens of average focal length. To meet such conditions, photographers use wide-angle lenses, that is, specially ground lenses of extremely short focal

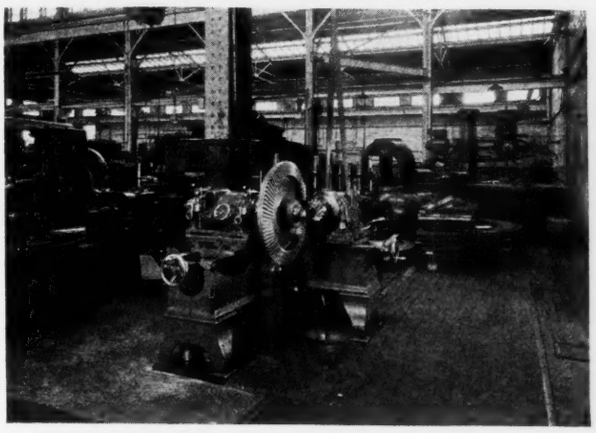


Fig. 3. A Photograph that was Taken with a Wide-angle Lens Having a Focal Length of 4 Inches

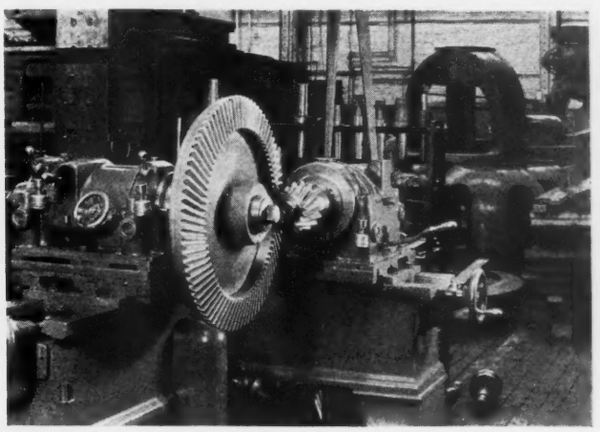


Fig. 4. Another Photograph Taken from the Same Position with a Lens of 12 Inches Focal Length

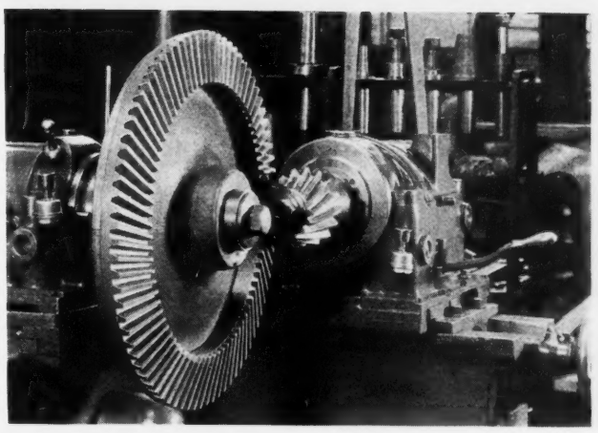


Fig. 5. A Third Photograph Taken from the Same Position with a Lens Having a Focal Length of 18 Inches

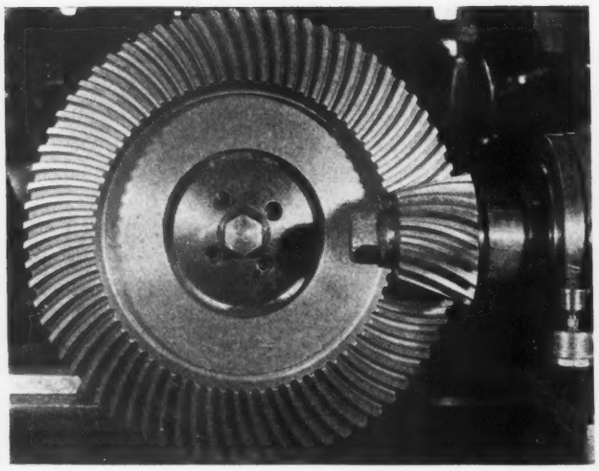
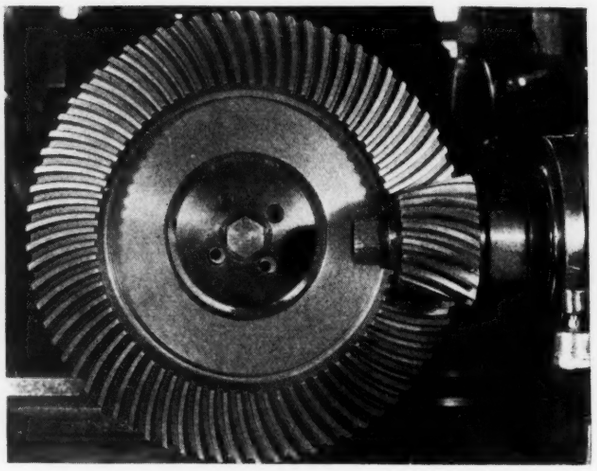


Fig. 6. Photograph Taken with Incandescent Lamps Arranged as Shown at A, Fig. 10, so as to Give the Proper Relief

Fig. 7. The Use of a Reflector on the Floor, as Shown at B, Fig. 10, Gives More Detail at Lower Part of Gear



length covering angles of view as great as 130 degrees.

The difference in scope covered by lenses of varying focal lengths is illustrated by Figs. 3, 4, and 5. Fig. 3 shows a photograph taken with a wide-angle lens having a focal length of 4 inches; Fig. 4, one taken with the back combination of a triple convertible lens having a focal length of 12 inches; and Fig. 5, a photograph taken with the front combination of a triple convertible lens having a focal length of 18 inches. The chief objection to wide-angle lenses is to be found in their violent rendering of perspective when used close to the subject. Generally speaking, wide-angle lenses are not used except in cases where the photographer has no choice of focal lengths.

A triple convertible lens is admirable for machine photography. Such a lens is composed of two elements—front and back. Each element is a complete "objective" having a different focal length. When used together, they form a third lens having a focus much shorter than that of either element used separately. If your photographer uses a 5- by 7-inch camera, his lens will probably have a series of focal lengths of 8, 12, and 18 inches.

Artificial Means of Lighting the Subject to be Photographed

The presence of areas of dark metal on machines adjacent to areas of glaring high lights from polished surfaces does not appear to be unnatural to the eye, but a machine photograph that lacks detail in both high lights and shadows is necessarily high in contrast, and never fails to be classified as unsatisfactory. Excessive contrast is the enemy of good machinery pictures. Intelligent handling of an ample amount of artificial light is one method of reducing excessive contrast and obtaining pleasing gradations. A proper understanding of how to do this is of importance in obtaining good results.

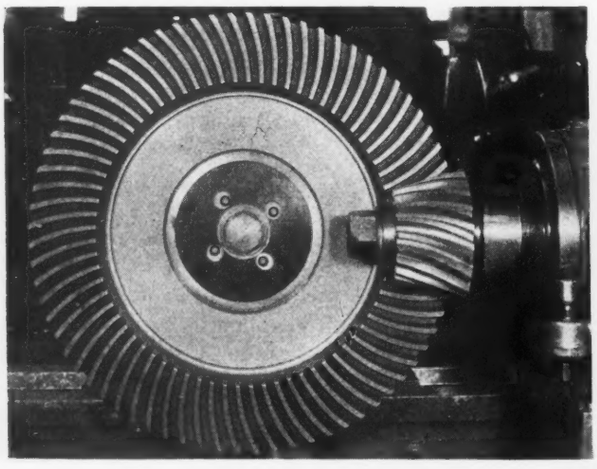
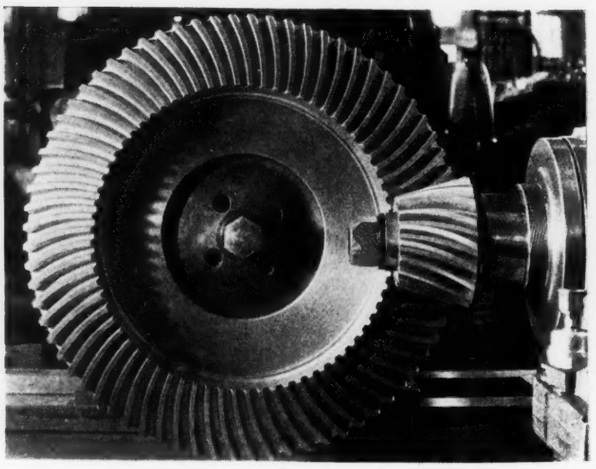


Fig. 8. "Flat" Lighting Gives Detail Over a Large Area, and is Obtained by Placing the Lights as Indicated at C, Fig. 10

Fig. 9. Unusual Lighting Effects may be Obtained by Placing Lights on One Side of the Camera Only, as Indicated at D, Fig. 10



Incandescent lamps of 500 or 1000 watts, held in suitable reflectors, are popular with many photographers who do machinery work. The Eastman Kodak Co.'s Model B Kodalite uses a high-intensity 500-watt lamp in an aluminum painted reflector that spreads the light evenly and softly. The photographs accompanying this article were made with lamps of that type.

The average machine subject is best lighted from each side of the camera with the sources of light at an angle of about 45 degrees in relation to the subject. To obtain the proper relief (illusion of depth) one source of light should be about one-quarter of the distance nearer the machine than the other, as indicated at *A*, Fig. 10. This arrangement of lamps causes a shadow to fall on the side of the machine faced by the more distant lamps, and yet these lamps illuminate sufficiently to record adequate detail in the shadows—an important point in subduing contrast. An example of the results obtained with this type of lighting is shown in Fig. 6. The lamps to the left of the camera were six feet from the gear-testing machine, while the right-hand lamps were at a distance of eight feet from the machine.

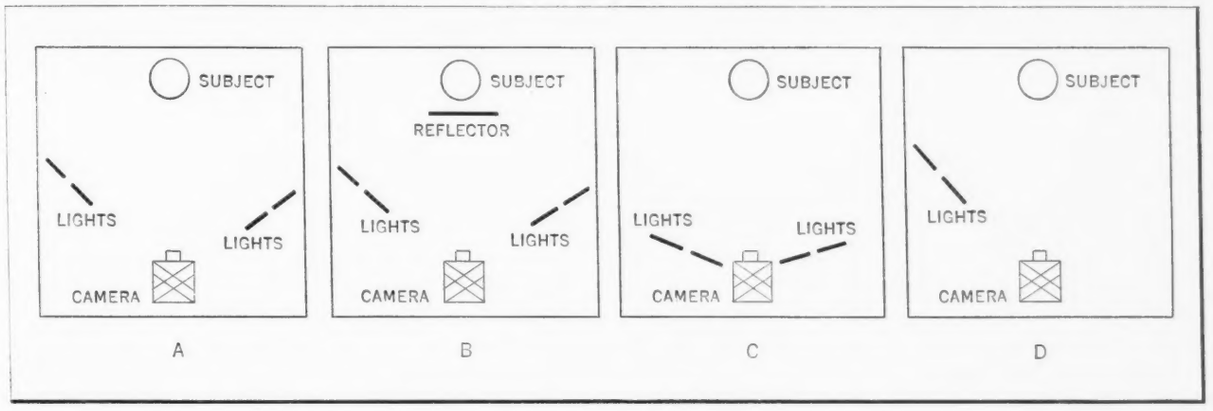


Fig. 10. Diagrams Showing Relative Positions of Camera, Subject, and Lights in Taking Photographs Shown in Figs. 6, 7, 8, and 9

The Use of Reflectors

There is one objection to the photograph reproduced in Fig. 6. As the lamps were slightly above the center of the gears, the lower part of the large gear, being at a greater distance from the light sources, received the least illumination, and, consequently, is darker than the rest of the gear. (Light varies inversely as the square of the distance.) The remedy is to place a reflector of white paper or cloth on the floor, as indicated at *B*, Fig. 10, near the dark area. Such a reflector will throw light into the shadowed area. Fig. 7 illustrates how the use of a reflector adds detail to the bottom of the large gear.

Thus a reflector is a necessary accessory in photographing machinery. It is useful for reflecting light into shadowed areas anywhere on a machine. A piece of beaver board or masonite, painted white, makes a good reflector. Some photographers cover beaver board with sheets of tin foil and get excellent results.

If good detail over the largest possible area of a photograph is wanted, "flat" lighting should be used. This is obtained by placing the lamps nearer the camera and equidistant from the work, so that the rays will strike the subject at almost 90 degrees to its plane, as indicated at *C*, Fig. 10. The objection to this sort of lighting is that relief and modeling are destroyed, making it difficult to differentiate the depths between planes. As an example, such lighting was used in making the photograph shown in Fig. 8. The absence of shadows throws the different surfaces into practically the same plane.

Strong relief, sometimes desired for special effects in advertising illustrations, is obtained in numerous ways. A simple example is "side lighting"—that is, placing the light source on only one side of the camera and at an angle of at least 45 degrees, as shown at *D*, Fig. 10. This arrangement gives greater depth and contrast. Fig. 9 illustrates the result of side lighting. Note the heavy shadow thrown into the recessed web by the gear teeth on the left-hand side of the flange. Only when in possession of information such as this can the engineer appreciate the photographer's problems.

If the light on the subject is too harsh, pieces of white muslin cloth should be placed in front of the lamps. The fine meshes break up the direct rays into a softer, more general illumination.

After the lighting has been satisfactorily arranged, the photographer studies the machine for points of extreme brilliancy on highly polished surfaces. Next he locates these points by viewing the machine from the angle at which the camera "sees" the subject.

Areas of extreme brilliancy should be softened by a thin application of ordinary putty or plastilina, both of which are obtainable at paint stores. Fig. 11 shows the way in which putty or plastilina should be applied to polished metal surfaces, and Fig. 12 shows how it should be rubbed down with waste.

The Use of Flashlight for Taking Machinery Photographs

Flashlight is preferred by many photographers for taking machinery photographs. There are two reasons for this—first, it is easy to manipulate, and second, it gives a less harsh light than incandescent bulbs.

Danger of fire or explosion and the annoyance of smoke and noise have prompted many concerns to ban the use of flashpowder. Today, most photographers who have a preference for flashlight in machine photography have adopted the "photoflash" bulb. This is an incandescent light bulb filled with oxygen and aluminum foil, which, when ignited, produces an instantaneous (about one-fiftieth of a second) flash of highly actinic light. There is no noise or smoke, just a flash of light, nicely diffused and admirable for machinery pictures. Current from an ordinary small dry-cell battery in the handle of a reflector provides ample heat in the delicate tungsten filament to ignite the foil.

Fig. 11. Putty or Plastilina should be Applied to Highly Polished Metal Surfaces to Soften the High Lights

The same lighting effects obtainable with incandescent lamps can easily be secured with photoflash lamps arranged in series on a long extension cord. With this arrangement, all the lamps flash simultaneously when the current is turned on. Whether flashlight, photoflash bulbs, or incandescent lights are used, the best assurance against harsh lighting is plenty of light rightly placed to minimize deep shadows, and plenty of exposure.

Correct exposure is the keystone of good photography. The variable factors in machine photography—namely, type and color of machine, power of illuminant, distance of lamps from subject, lens opening, type of film or plate used—prevent giving blanket rules. Therefore, it is plain that the experience of the photographer is the foundation of his ability to obtain consistently good results. When he is in doubt, he will tell you, he attempts to overexpose, not excessively, but enough to assure good detail in the shadows. As previously pointed out, this practice is a good one to combat the ever-present danger of high contrast.

Fig. 12. After being Applied as Illustrated in Fig. 11, the Plastilina should be Rubbed Down with Soft Waste

The third article in this series will deal principally with the kind of film that should be used for machinery photographs. This article will be published in April MACHINERY.

* * *

A complete study of bolt and nut threads, made by Professor G. Berndt of Dresden, Germany, has been published by R. Stock & Co., Berlin-Marienfelde. This publication covers thirty-nine large magazine size pages, and is, of course, printed in the German language.

Designing Skiving Tools for Formed Parts

Methods of Laying Out Skiving Tools for Accurately Finishing Formed Parts through the Application of a Shaving-Shearing Cut

By JAMES L. INGALLS
Ingalls Engineering Service, Springdale, Conn.

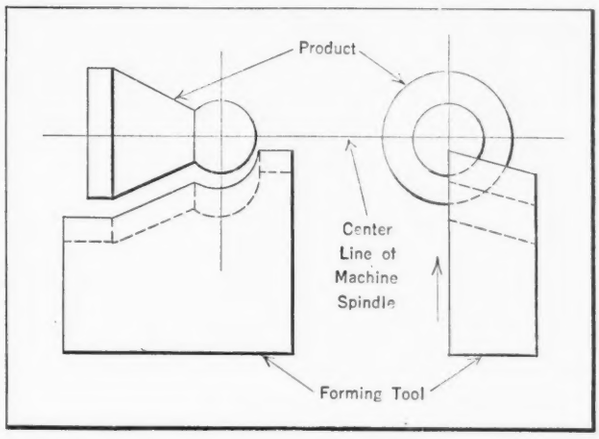
THE most commonly used forming tool for circular turning is the full-form or radial-feed type shown in Fig. 1. The cutting edge has the true form of the product and lies in a horizontal plane passing through the center of the product. This type of cutter is fed radially into the work. It is obvious that all portions of the cutting edge will eventually cut at the same time. This necessitates a slow feed to avoid chattering, and considerable force is required to feed the tool into the work, thus making it rather slow for use on production work.

There is another type of forming tool (Fig. 2) called a "skiving" or "undercutting" tool. This tool is fed into the work tangentially. The contour of the cutting edge is not the same as the true contour of the product, and it lies in a plane set at two different angles. This allows the points of the cutting edge to come into action consecutively. That is, the work is finished to size at one end as soon as the point of the tool at *O* passes the center line of the work. The finishing to size then continues along the work, the entire length being turned to size when point *A* passes the center line.

The true form of the product appears nowhere on the skiving tool, and a corrected contour is required for the cutter employed to form the tool. The true form may be found, however, when the tool is in the cutting position by projecting all points of the cutting edge perpendicularly on a vertical plane that is parallel to the center line of the product, as in Figs. 2 and 4. This corrected contour is not always produced accurately on the tool, and hence, there is an adjustment on the machine for tipping the tool sidewise, to minimize the error. However, this adjustment of a wrongly constructed tool never gives a perfect product, as when adjusted for horizontal surfaces, it is off for the vertical surfaces, and vice versa.

The views in Fig. 3 show how the position of a skiving tool is obtained. At the left the tool is shown machined to the angles a and $(f + e)$. Angle $(f + e)$ is a cutting relief, and angle a gives the condition of consecutive cutting to the cutting edge OA, which is the resulting intersection of the two angular planes of angles a and $(f + e)$. The top of the tool in the side view is horizontal, and, of course, will drag on the product as the tool is fed in. To relieve this drag, we tip the tool down on line OH as an axis, so that the top is at an angle f with the horizontal, as shown in the central views, Fig. 3. Now, when we thus tip the tool, point A in the top view will travel from a horizontal line ON in an arc about point O as a center to

Fig. 1. Full-form Radial-feed Type of Tool Commonly Used for Turning Formed Work



JAMES L. INGALLS was born in Millville, Mass., in 1878. He learned the machinist's trade at Whitins Machine Works of Whitinsville, Mass., and obtained his engineering education at Tufts College. After about a year with the Electric Compositor Co. at Woonsocket, R. I., he became connected with the Brown & Sharpe Mfg. Co., Providence, R. I., where he remained for eleven years, first serving as draftsman and later being placed in charge of screw machine production tool design. In 1916 he became associated with the Yale & Towne Mfg. Co., Stamford, Conn., as chief draftsman of production tools and special machinery. He held that position until 1930, when he started his own business, the Ingalls Engineering Service at Springdale, Conn.

the new position on line OM_1 shown in the side view. Also, point A will travel down vertically to a new position A_1 indicated in the end view. The resulting angular line OA_1, which is the cutting edge, should be horizontal to cut horizontal surfaces. So we must rotate the top plane only on OM as an axis until OA_1 is back in the horizontal line ON, as shown in the group of views at the right in Fig. 3. The tool travels in the direction indicated by the arrow when cutting.

Rules for Laying Out Skiving Tools

Fig. 4 shows how the data for constructing the skiving tool shown in Fig. 2 are obtained. Before proceeding, it may be well to state the following principles:

1. The position of a straight line is fully determined by any two points in the line.
2. A straight line in one view is always a straight line in any other view.
3. Parallel lines in one view will always be parallel in any other view.
4. To produce a vertical surface on a product, the cutting edge of the tool must lie in a vertical plane.
5. To produce a horizontal surface on a product, the cutting edge of the tool must lie in a horizontal plane.

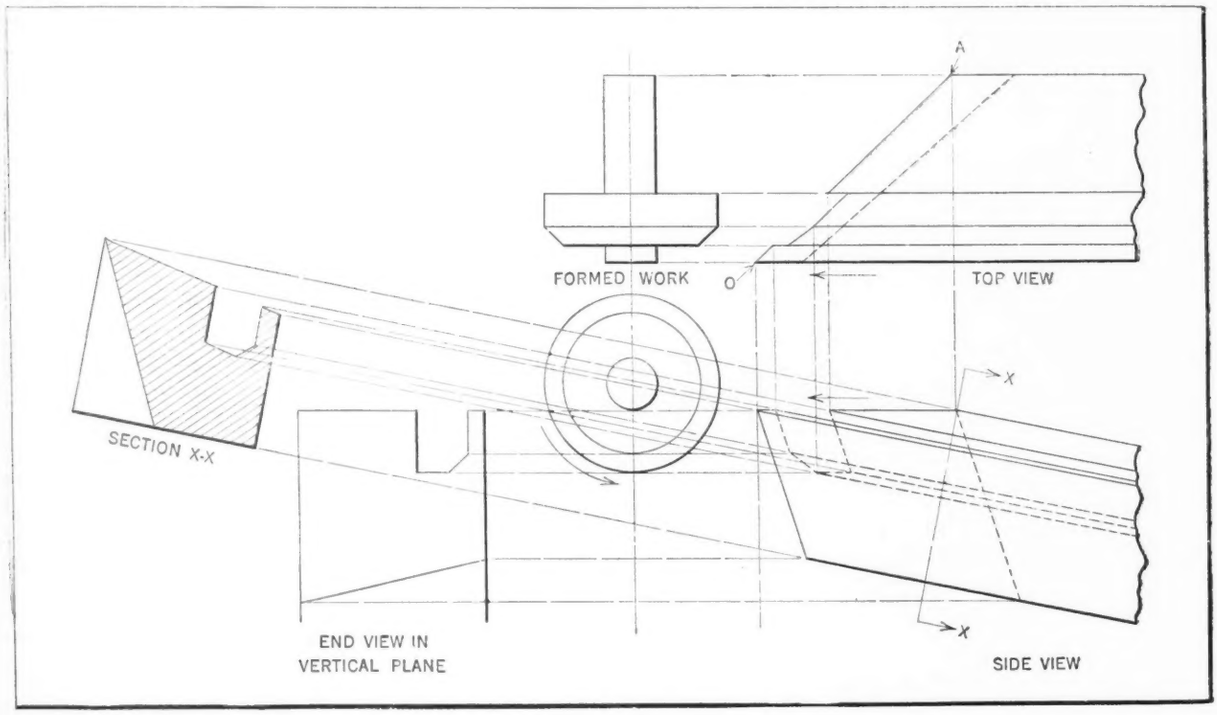
Now referring to Fig. 4, the tool is shown diagrammatically in the cutting position on the machine by top, side, and end views. An oblique or sectional end view X–X is shown, which has the contour or profile actually machined on the tool. The consecutive cutting action is obtained by machining the tool to the angle a, which brings the cutting edge OA at the top of the tool when the top surface is in a horizontal plane, as shown in the views to the left Fig. 3. Machining the tool to the angle $(f + e)$ as measured in the side plane produces the angle b in the section X–X. Tilting the tool downward at the angle f provides for the drag relief, as mentioned before.

The section X–X, Fig. 4, will show the actual shape and size of the contour to be milled or planed on the tool. Now start by cutting the angles a and $(f + e)$ with the top of the tool horizontal. Then we have points O and A in angle a, and by projecting point A down into the horizontal top of the side view, we obtain points B and C and $OB = OC$. This is now as shown at the left, Fig. 3.

Next the tool is tipped down on axis OH to an angle f with the horizontal, Fig. 4. When thus tipping the tool, point C, being in the top plane, will travel on an arc about point O as a center into a new position on line OO_2. This gives a slant to the cutting edge OA, as shown by line OA_1 in the central views, Fig. 3.

Now bring point D, Fig. 4, back into the horizontal plane by rotating the top plane only on OO_2 as an axis until point D cuts the horizontal at E. When this top plane is rotated, point D travels from D to E in a path at right angles to axis OO_2. Therefore, ODE is a right triangle. Now the angle of the top of the tool, after bringing point D back into the horizontal position, is shown by angle w in the sectional end view. Here G_2H_2 is equal to the new width of the tool, which is less than the original width AB. Now F_2H_2 is the projection of, and equal to, DE, shown in the side view. Line F_2H_2 is at right angles to G_2H_2, giving

Fig. 2. Skiving Tool for Finishing Formed Work by Employing a Tangential Feeding Movement



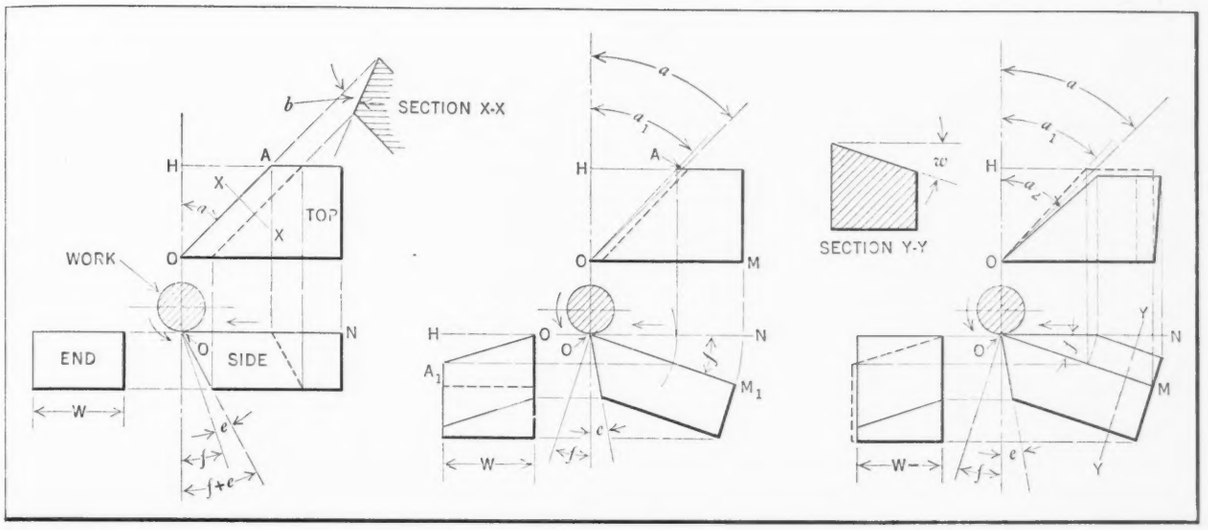


Fig. 3. Diagrams Showing Successive Steps in Developing the Skiving Type of Cutter for Finishing Formed Work

another right-angle triangle $G_2F_2H_2$. It also slightly increases the angle a in the cutting position, and the tool is cut to the angle a_2, but the angle a_2 need not be considered when laying out the contour mathematically, as will be shown later.

Notice that lines *OF* and *GF* of the top view and line *OE* in the side view are coincident with line G_2F_2 in the sectional end view. In the side view, *OE* (the horizontal cutting edge) will, of course, cut a horizontal surface; hence, all other horizontal surfaces must be parallel with *OE*. Also, if line G_2F_2 in the oblique or end section view is a correct view of *OE* in the side view, then all parallel horizontal lines in the side view will be shown parallel to G_2F_2 in the oblique view. Therefore, it may be stated that all horizontal lines on the product will be shown parallel to line G_2F_2 in the oblique view.

Now we will consider the positions of the vertical cutting edges that determine the lengths of the horizontals on the product. As previously stated, the cutting edges for vertical surfaces on the product must be in the same vertical planes as the surfaces cut. The distances between vertical surfaces on the tool must then be the same as the corresponding distances between the vertical surfaces on the product. As the vertical planes are at right angles to the center line of the product, all horizontal lengths on the product will be measured in their true lengths along line G_2H_2, or a line parallel to it, in the oblique view.

Data for the vertical lines on the product are found as follows: Let outline *VWXYZ* of the end view, Fig. 4, be a true form in the vertical plane. Pass vertical cutting planes 1, 2, and 3 through the vertical plane that is parallel to the center line of the product and parallel to the side of the tool shown in the top view. These planes pass through line *VW*, point *X*, and line *YZ*, respectively. Plane 1 is shown in the side view by an invisible section M_2MM_3. Line MM_2 is the intersection line where this plane cuts the inclined top surface of the tool. Project point *W* into the side view, cutting line MM_2 at point *L;* and line *VW*, projected, will give *MN* vertical to the line of projection. Then draw *LK* at right angles to line MM_2 and LN_2. Now *LK* shows the actual depth of the cut on the tool for line *VW*.

Line *LK* is at right angles to the bottom of the tool; and as it lies in the cutting plane 1, it is parallel to the side of the tool and vertical to G_2A in the oblique view. It is projected into the oblique view as *PQ*. Then all vertical lines on the product will be shown in the oblique view at right angles to G_2A or D_2A_2.

Line *TS* is also found by the method just described, using plane 3, which gives line *JU* in the side view. Line *QR*, being a horizontal line in the true form as *WX*, may be found by drawing *QR* through point *Q* parallel to G_2F_2 until it intersects the cutting plane 2 at point *R*. Again, it may be found by projecting the imaginary line X_2X by the method used for line *VW*, thus locating point *R*. Then connect points *Q* and *R* by a straight line.

To find the taper line *XY* in the oblique view, locate points *R* and *S* from points *X* and *Y*, and then connect points *R* and *S* by a straight line. The location or projection of any curved surface is accomplished by simply assuming a suitable number of points in the true form, and after projecting these points into the oblique view, tracing a smooth curve through them.

From the data thus found, we can form the six rules that follow:

Rule 1—All vertical lines on the product will be drawn at right angles to line A_2D_2 in the oblique view.

Rule 2—All horizontal lines on the product will be drawn parallel to line G_2F_2 in the oblique view.

Rule 3—All vertical distances on the product will be measured along a line at right angles to A_2D_2 from the line G_2F_2 in the oblique view.

Rule 4—All horizontal distances on the product will be measured along line G_2H_2 or A_2D_2 in their true lengths.

Rule 5—Taper lines on the product may be found by locating two points in the taper on the product, projecting these two points into the oblique view, and then connecting them by a straight line.

Rule 6—To develop the corrected profile of any curved surface such as shown in Fig. 5, draw ordinates cutting the curve at several points as shown, and project these points into the oblique view. Then draw a smooth curve through these points.

In laying out the corrected contour on the tool, we may use either of two methods. The first method is that of locating the points of the contour geometrically by projection, as already explained with reference to Figs. 3 and 4. The second method is that of using the oblique view only, finding angle w and a constant multiplier for determining all vertical lines. The latter method of computing all data mathematically may suit the requirements of the designer in some cases better than the geometrical method.

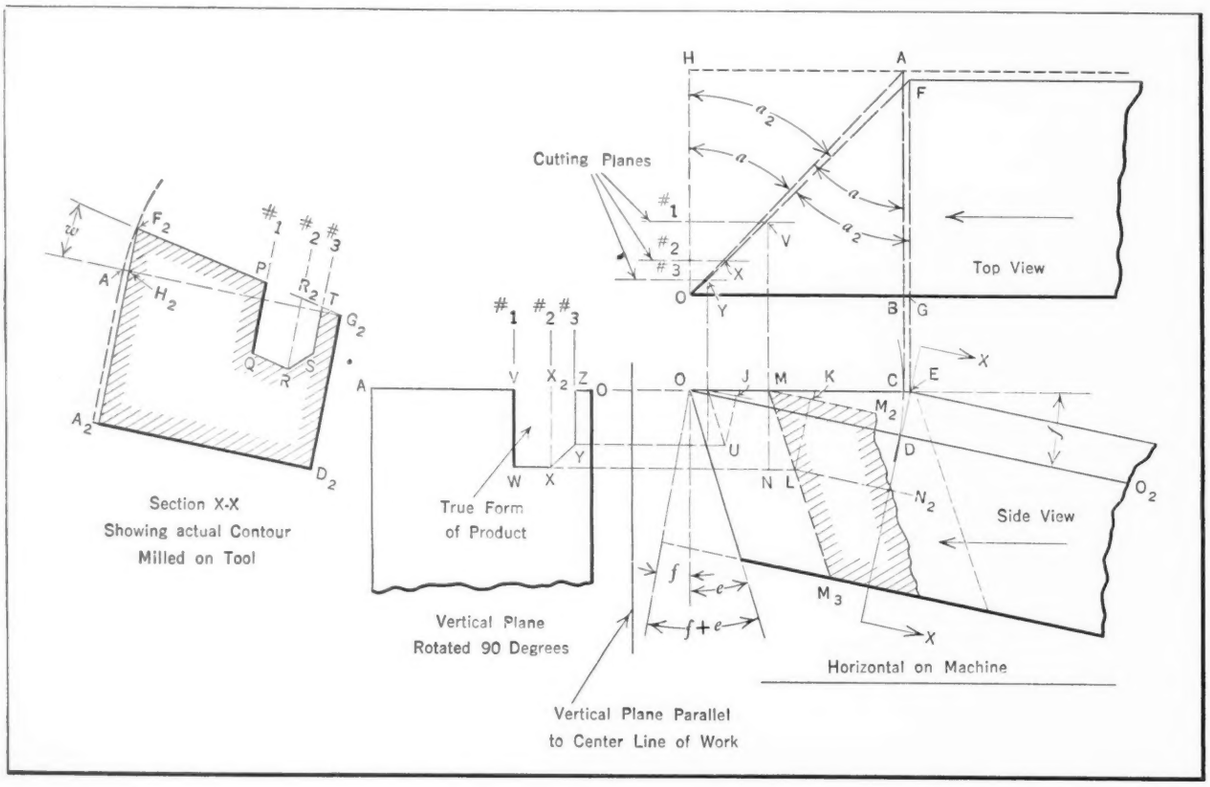


Fig. 4. Views Illustrating Method of Projecting True Form of Work and the Modified Profile of Cutter for Machining a Formed Skiving Tool

The computing method will now be described. Find angle w, Fig. 4, by applying the equation:

$$\text{Sin } w = \frac{F_2H_2}{G_2F_2} = \frac{DE}{AB} = \frac{OD \tan f}{\frac{OB}{\tan a}}$$

$$= \frac{OD \tan f \tan a}{OB} = \tan f \tan a$$

Thus we have the formula:

$$\text{Sin } w = \tan f \tan a \qquad (1)$$

Notice here that angle w is determined solely by the angles f and a.

Now find the constant multiplier. By geometry, angle NML (Fig. 4) = angle e, and angle MLK = angle $(e + f)$.

In triangle NML,

$$ML = \frac{MN}{\cos e} = \frac{VW}{\cos e} \qquad (2)$$

In triangle MLK,

$$LK = ML \cos (e + f) \qquad (3)$$

But from Equation (2),

$$ML = \frac{VW}{\cos e}$$

Substituting this value of ML in Equation (3),

$$LK = VW \left[\frac{\cos (e + f)}{\cos e} \right]$$

Now VW is the given true distance on the work and LK the corresponding corrected distance machined on the tool. Thus, the constant multiplier for all vertical distances equals

$$\frac{\cos (e + f)}{\cos e} \qquad (4)$$

Fig. 5 shows a drawing of a knob, and Fig. 6 shows a tool laid out for forming the knob by calculating the various dimensions. In laying out a tool, we first have to assume practical angles for a, e, and f.

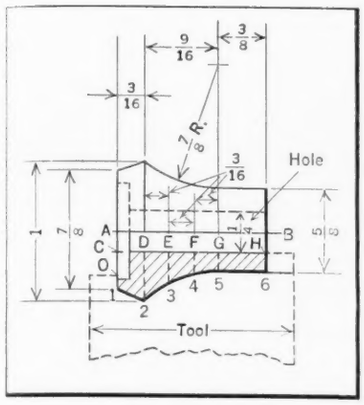


Fig. 5. Work for which Formed Skiving Tool Shown in Fig. 6 was Designed

Let us assume that angle $a = 30$ degrees, angle $f = 5$ degrees, and angle $e = 12$ degrees. Then, according to Formula (1), we have:

Sin w = tan f tan a = tan 5 degrees tan 30 degrees = 2 deg. 53 min.

Now construct the section of the tool as in Fig. 6 with line G_2F_2 at an angle of 2 degrees 53 minutes with the horizontal D_2A_2. The width of the tool must be sufficient to finish the ends of the work and extend far enough to cut to the hole in the product and the recess on the left-hand end. From Formula (4) the constant multiplier is,

$$\frac{\cos\,(e+f)}{\cos e} = \frac{\cos 17 \text{ degrees}}{\cos 12 \text{ degrees}} = 0.9776 +$$

Now draw ordinates for the six points in the true form, as shown in Fig. 5. Also draw ordinates for these points in the section XY, Fig. 6. The latter ordinates, in the section view, will be the same distance apart as those in Fig. 5. Now all vertical distances in Fig. 6 that correspond with $C1$, $D2$, etc., in Fig. 5 will be multiplied by the multiplier 0.9776, and the result measured off on ordinates $C_1 1_1$, $D_1 2_1$, etc., respectively, from line G_2F_2 in section XY, Fig. 6.

The distances $E3$ and $F4$, Fig. 5, on the product may be scaled; or if greater accuracy is desired, they may be calculated. After determining the six points in the section view, Fig. 6, connect 1_1 and 2_1 by a straight line; draw a smooth curve through points 2_1, 3_1, 4_1, and 5_1, and connect points 5_1 and 6_1 by a straight line that will be parallel to line G_2F_2.

It is not necessary to locate both points 5_1 and 6_1, for we can locate either 5_1 or 6_1 and draw a straight line through the point parallel to line G_2F_2 that will locate the other point in the parallel vertical plane $H_1 6_1$ or $G_1 5_1$.

The designer may assume that the center line of the product is coincident with line G_2F_2 in Fig. 6 and work to radial distances on the product; then the ends can be cut to suit the hole and the recess.

Any type of cutter for making the tool will be made with the contour shown in section XY, Fig. 6, as a templet, the tool being held in the position shown for milling or planing. The tool is also held as in Fig. 6 for milling angle a_2, Fig. 4. This angle is found from the equation:

$$\text{Tan } a_2 = \frac{\tan a}{\cos f \cos w}$$

The angle a_2 is to be measured in a horizontal plane.

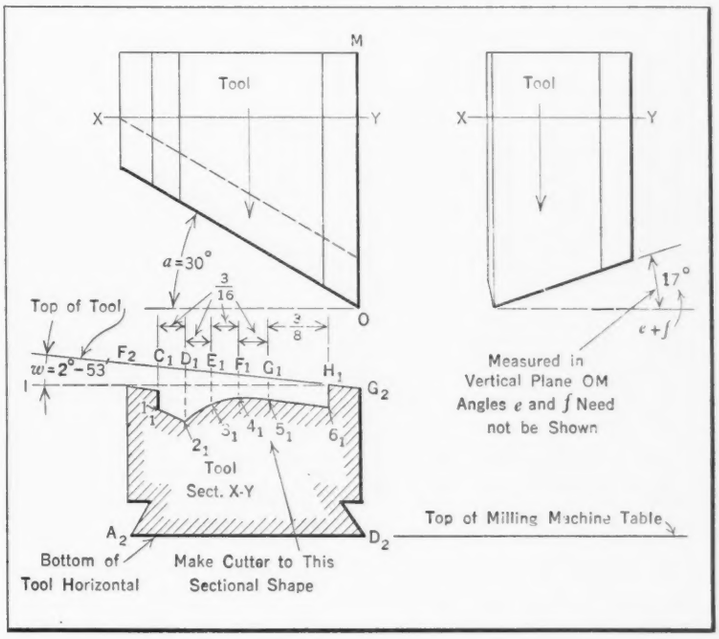
Even with the drag angle f incorporated in the tool, some users provide a means of dropping the tool slightly to allow the cutting edge to clear the work when the tool is returned to the starting position, and then raising it to the cutting level again when the tool advances.

To the best of the writer's knowledge, this is the first time that a complete treatise on the subject has been presented.

* * *

The important part played by elevator equipment in modern office buildings is indicated by a record of the elevator equipment to be installed in the seventy-story office building that is to be the largest of the group of structures popularly known as "Radio City" in New York. In this building, there will be seventy-six full-automatic Westinghouse elevators, which will be installed at an approximate cost of $2,500,000. Twenty-four of the elevators will operate at a speed of 1200 feet a minute, making it possible for an elevator running express to the sixty-fifth floor to cover the whole distance of 805 feet in about three-fourths of a minute. When operating at full schedule, the seventy-six elevators in the building will travel over 21,000 miles a day.

Fig. 6. Diagrams Showing Method of Milling Skiving Tool for Finishing Formed Part Shown in Fig. 5

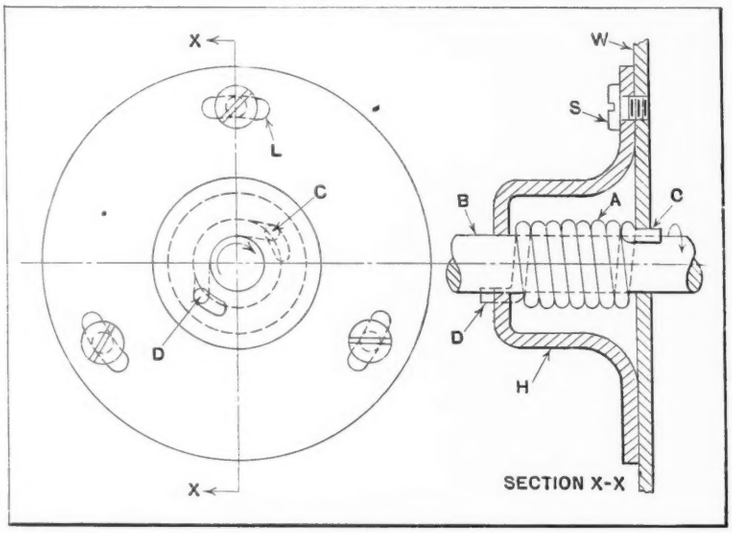


Shaft-Gripping Hub for Sheet-Metal Wheels

By ERNEST C. ALLEN

Anyone who has attempted to make wheels or other rotating parts from sheet metal has encountered the problem of fitting the wheels with satisfactory hubs. Generally the sheet metal is too thin to permit keys or set-screws to be employed for fastening the wheels to their shafts, and it is therefore necessary to provide hubs made from cast or turned pieces.

In the illustration is shown a hub for sheet-metal wheels in which is incorporated a convenient means for securing the wheel to its shaft or removing it without marring the surface of the shaft. The hub *H* is a cap made from sheet metal and is adapted for production in large quantities. This hub is secured to the sheet-metal web *W* of the wheel by three set-screws *S* which pass through the elongated holes pierced in the hub. The hub encloses the helical spring *A*, which provides the means for clamping the wheel to the shaft by making use of the snubbing-grip effect obtained when a closely wound helical spring fitted tightly over a cylinder is subjected to a pulling force at one end in a direction tending to tighten or contract the coils. The gripping force on the shaft or cylinder is sufficient to resist, to the point of destruction of the spring, any attempt to rotate the spring about the cylinder.



Hub Construction of Sheet-metal Wheel with Helical Spring Arranged to Clamp Wheel to Shaft

In this case, the spring *A* grips the shaft *B* tightly, and any tendency of the wheel to rotate in the direction of the arrow pulls on the hooked end *C* of the spring, which passes through an elongated hole or slot in web *W*, causing the spring to grip the shaft more tightly. Thus the wheel will drive the shaft in the direction indicated by the arrow.

The spring acts in the same manner when the wheel is rotated in the opposite direction, except that the hooked end *D* of the spring, which passes through an elongated hole in the hub *H* takes the driving strain, causing the spring to contract and grip the shaft as explained. The elongated holes free the hooked end of the spring opposite the end that does the driving from contact with the wheel.

Thus when the wheel drives the shaft in the direction of the arrow, the driving force is exerted on the hooked end *C* of the spring, while the elongated slot in the hub *H* allows the wheel to rotate without moving or exerting force on the hooked end *D*. Obviously, if force is exerted on the hooked end *D* as well as on the end *C*, the unwinding effect on the spring at end *D* would tend to cancel or equalize the tightening or driving effect on end *C* when the shaft is driven in the direction indicated by the arrow. By removing one of the hooked ends of the spring *A*, the wheel may, within certain limitations, be used in place of a ratchet wheel for driving in one direction only. For such use the hooked end of the spring would be passed through a close fitting hole instead of a slot.

With the wheel arranged as shown in the illustration, it will drive the shaft in either direction, as described. Exactly the same arrangement is used when it is desired to have the shaft drive the wheel in either direction. When the shaft drives the wheel in the direction of the arrow, the rotating force is transmitted to the wheel by the hooked end *D* of the spring. On reversing the direction of rotation, the hooked end *C* transmits the driving force.

The slots in the hub flange permit the hub to be rotated with respect to the web *W*, so that the spring may be given an initial gripping tension on the shaft that will prevent any looseness or backlash. This clamping tension is increased by holding the wheel hub stationary and revolving the wheel web *W* in the driving direction indicated by the arrow. When the desired tension is obtained, the hub and wheel flange are fastened securely together by tightening the screws *S*. Of course, rotation of the wheel in the opposite direction, with respect to the hub, will tend to unwind the spring and therefore increase its inside diameter so that it will cease to grip the shaft. Thus it is evident that the design provides a very simple means for mounting the wheel on a shaft or removing it.

* * *

The nineteenth Foreign Trade Convention, under the auspices of the National Foreign Trade Council, will be held this year at Honolulu, T. H., May 4 to 6. Special attention will be given to trade with Japan, Australia, China, and the islands in the Pacific. The secretary of the Council is O. K. Davis, 1 Hanover Square, New York.

Hard-Facing in Machine Manufacture

Remarkable Results Effected by a Method for Preventing Wear and Salvaging Worn Punches, Dies, and Machine Parts

By J. C. HUSTON, Haynes Stellite Co.

PROBABLY one of the greatest problems encountered in industry is that of abrasion. The clang of steel on steel as shears clip off the end of a bar or punches smash their way through plate may be music to the production man, but it is an alarm bell to the maintenance and repair department. The clashing or rubbing together of steel parts means abrasion that wears away the metal until its usefulness is impaired and replacement becomes necessary.

In some instances, this process of destruction cannot be remedied, but many times it is possible to lengthen the service life of equipment greatly by hard-facing the parts subjected to the greatest wear. Hard-facing materials, which may be applied either by the oxy-acetylene or the electric arc process, have become increasingly important during the last few years. Industry is generally reluctant to adopt any process or method of manufacture that increases the initial expense. However, exhaustive studies and long-time tests have demonstrated clearly the economy of hard-surfacing when production expenses are broken down into unit costs.

As a result, the practice of covering parts exposed to abrasion with a layer of wear-resisting alloy has been accepted as standard practice in many fields. The ease with which these alloys can be applied, coupled with the saving in time and the increase in life, has provided a most suitable method of combating wear. Applications for hard-surfacing may be found in practically every plant, either in the fabrication of some product or in everyday plant maintenance.

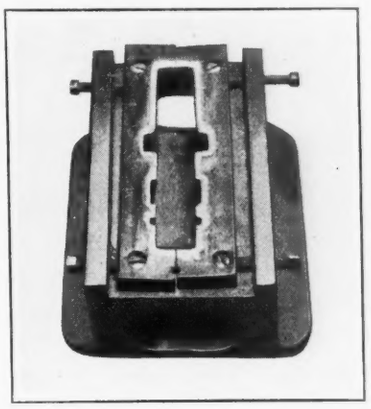


Fig. 1. Hot-trimming Die, Hard-faced on the Edges

Increasing the Life of Punches and Dies

One of the most important uses of this process is the hard-facing of punches and dies for drawing, flanging, trimming, and bending. In many automobile plants, where hot-forming and trimming are employed to a great extent, the substitution of hard-surfaced carbon steel dies for more expensive special steel dies has attracted particular interest. Running-board brackets, brake pedals, steering arms, ring gears, steering knuckles and gears, generator poles, axles and axle yokes, crankshafts, clutch yokes, and camshafts are a few typical examples of the parts fabricated by means of forming and trimming dies. In many cases, dies that had previously been scrapped have been salvaged, built up and hard-faced, and then returned to use. Even better results were obtained with the salvaged dies than with new ones.

One large automobile manufacturer has found that it is possible to obtain six times as many generator poles from a single die since the die was hard-faced. The life of hot-trimming dies for brake pedals at this plant has been increased fourteen times by hard-surfacing. The die shown in Fig. 1 has been salvaged from the scrap heap and put back into use by rebuilding the worn edges with a wear-resisting alloy. The layer of alloy is but 1/8 inch thick and 3/8 inch wide. The die gives such satisfactory results that this method of procedure has been standardized. Since it is possible to rebuild these dies time and again after the first application has worn off, the saving resulting from this practice is considerable. Typical applications at another automobile factory include hot-trimming dies for ring-gear forgings for trucks and for double steering arms. In the first instance, an increased life ratio of 8 to 1 was obtained, while in the latter, the average life was three times as long.

The dishing and flanging punch and die shown in Fig. 2 are used on 1/8-inch soft steel plate. In the place of the tool steel that was formerly used, it is now possible to use mild steel, hard-faced only on the working edges. By this method longer life is obtained at both lower initial and unit cost.

Another company, engaged in the manufacture of railroad cars, uses dies over 9 feet long to bend the angles in 3/16-inch steel plate for box car ends. Hard-surfaced corners on a mild steel base give many times the life of similar dies fabricated from high-speed steel. An 11/16-inch punch, on which a 1/16-inch layer of hard-facing material had been deposited, was employed on 0.50 carbon hot steel plate, 1 inch thick, and showed practically no sign of wear after outlasting two ordinary steel punches. The cost of this treatment amounted to but a few cents per punch.

Reducing Wear on Machine Parts by Hard-Facing

It has been found to be decidedly economical to hard-surface many parts of machines that are particularly affected by wear. The feed-cam on an automatic milling machine, in a plant manufactur-

ing automobile parts, was operated under normal conditions for a period of from six to twelve weeks, after which it became necessary to replace it. The edge of this cam was hard-faced for its entire length to a depth of 1/8 inch, tapering to 1/16 inch on the smaller end. The cost of hard-facing was one-quarter that of a new cam, and its life was extended to one year. In another instance, it was possible to substitute hard-surfaced cam rollers of cold-rolled steel for hardened tool steel, with an increase in life of 300 per cent.

How Shear Blades are Salvaged

Shear blades for cold-shearing standard steel shapes have such a relatively short length of service that their replacement is a considerable item. One large machinery manufacturer has adopted the practice of reclaiming worn out blades by rebuilding the edges with a wear-resisting alloy. These salvaged blades last longer than new knives and

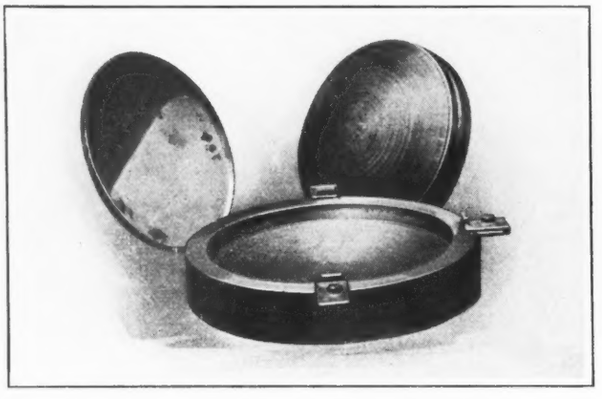


Fig. 2. Hard-surfaced Punch and Die for the Cold-dishing and Flanging of Soft Sheet Steel

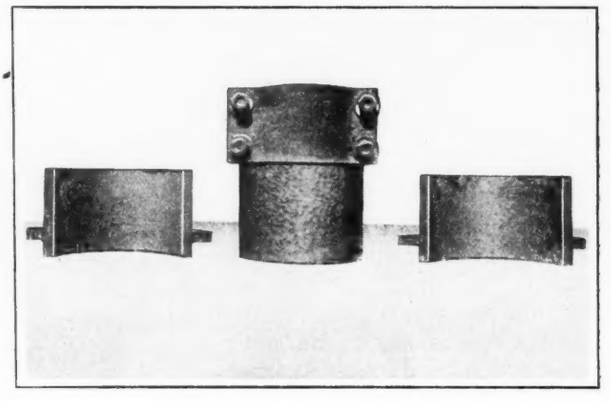


Fig. 3. Bearing and Bushing Showing Only Slight Wear after 1 1/2 Years of Service

require but a few minutes of the welder's time to produce a part better than the original at less than 3.5 per cent of the cost of a new blade.

In the joining of cylinders by the fire welding process, hard-faced welding rolls have continued in operation more than thirty times as long as ordinary cast-iron rolls. The scale adhering to cast-iron rolls pits them badly and necessitates regrinding after but a few feet of seam have been welded. With a hard-surfaced roll it is possible to grind the alloy until it is almost polished, and the adhering scale can be scraped off with a file each day without regrinding the roll.

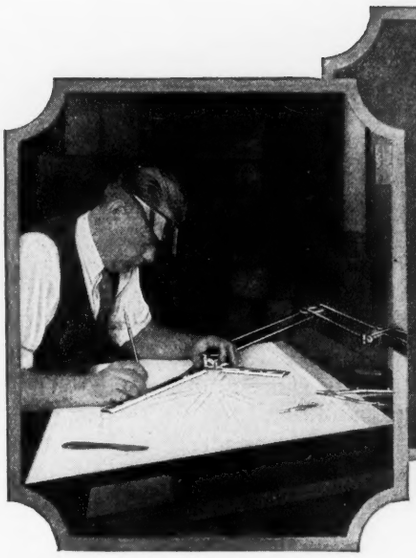
Rotary saws used to cut off the ends of carbon electrodes last twelve times as long after the teeth have been hard-surfaced, at an increase in cost of 56 per cent of the price of a new saw.

Innumerable minor applications have been found which, at a remarkably low cost, will lengthen the period of uninterrupted operation of equipment. Among a list of typical examples should be included feed rollers, rest bars, guide blocks, housing liners, clutch fingers and dogs, eccentric screws and keys, turret-lathe chuck collars, lathe centers, spindles and wobblers, and guides of all types. Experience has proved that the life of many such parts can be economically increased by the addition of a few ounces of a wear-resistant alloy.

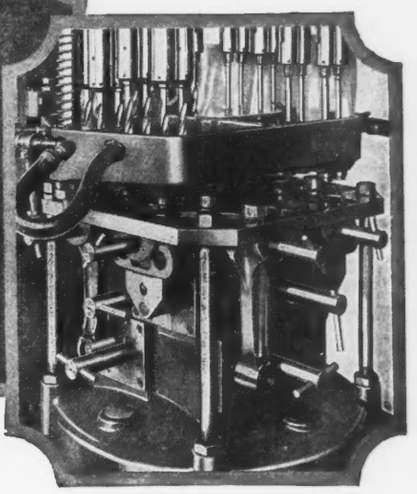
Many manufacturers producing machinery that is subjected to considerable abrasion in operation have standardized on hard-faced parts where the wear is most severe. For example, hard-surfaced parts are used extensively in pressed-brick machines. In cement mills, highly abrasive dust particles penetrate into moving parts, preventing proper lubrication and quickly cutting and pitting the metal surfaces. Special lubricants do not entirely remedy this condition, so hard-facing has been utilized in many places where a dust-laden atmosphere plays havoc. Stuffing-boxes and bushings on pumps, end bearings and bushings for feeders, conveyors, agitators, etc., all give trouble from this cause, and practically require surfacing with an abrasion-resistant alloy in order to insure dependable performance.

An example of the economy of this practice may be found in the application of such an alloy to the lubricated rear end bearings on a tube-mill feeder-arm. An ordinary bronze bushing had a life of about nine months, while a hard-faced bushing, at the end of thirty months, was still in good condition. Fig. 3 shows the bottom guide bearing and bushing for a traveling agitator that have been hard-faced on the wearing surfaces with a 3/16-inch layer of a wear-resisting alloy. These parts were examined after outwearing three ordinary bearings and bushings, and since they were in excellent condition, were put back into service.

Such uses of hard-facing, both in the manufacture of equipment and in its subsequent operation, are typical in every industry. A complete summary of applications would be practically impossible, but the few examples mentioned indicate the tremendous scope of this method of combating wear. Every day new uses are found, and every day old applications are establishing new performance records.



Design of Tools and Fixtures



Chuck for Boring, Reaming, and Facing Eccentrics

By CHARLES C. TOMNEY, Chief Tool Designer
Brunswick-Kroeschell Co., New Brunswick, N. J.

The special chuck shown in Fig. 1 is used on a Libby lathe for boring, reaming, and facing the eccentric shown in Fig. 2. After trying various means for machining eccentrics of this kind, including an indexing fixture, it was found that the chuck here illustrated gave the best results.

The first operation consists of boring and reaming the 1 15/16-inch hole, turning the hub *A*, Fig. 2, to a diameter of 3.550 inches, and facing surfaces *B* and *C*. The turning and facing are done by cutters set up in a standard facing head which is piloted in the reamed hole. The turret toolpost is not used for any of the operations, but a roughing head and a finishing head are employed.

For the first operation, the hub of the eccentric is centralized by means of a cast-iron bushing *D*, Fig. 1, bored about 1/16 inch larger in diameter than the rough hub of the casting. This allows suffi-

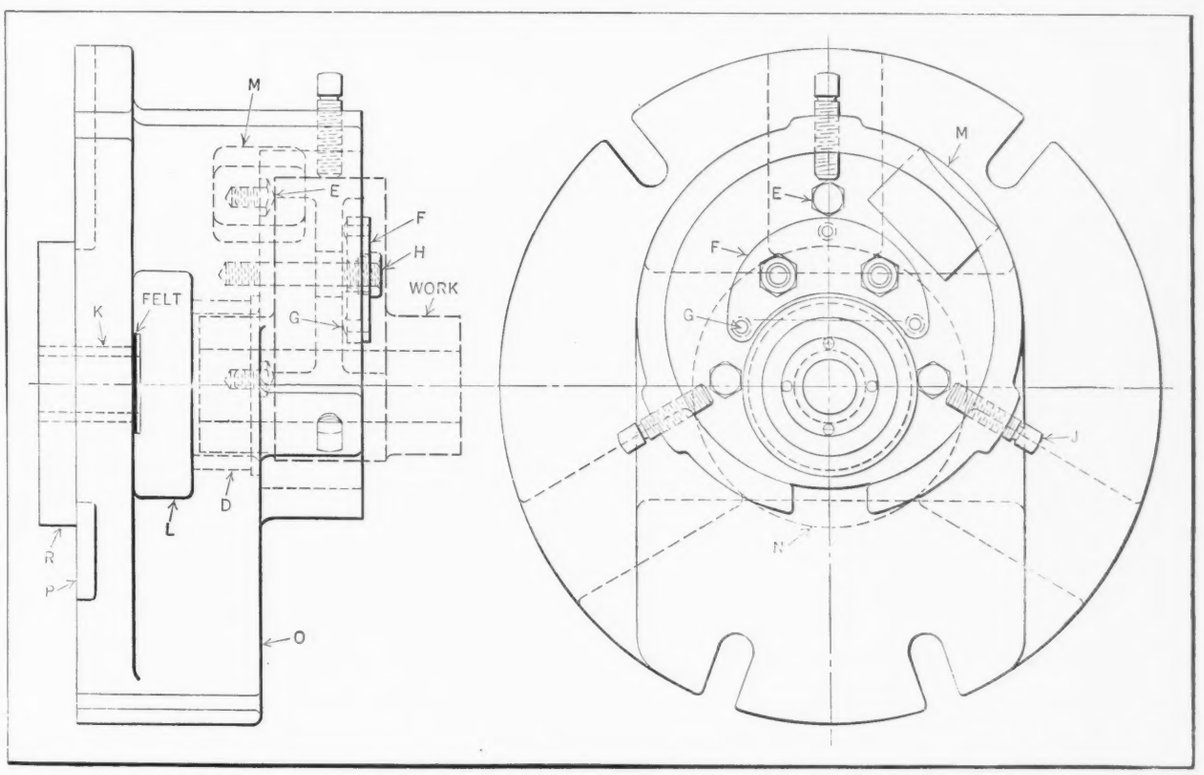


Fig. 1. Special Chuck for Holding Eccentric Shown in Fig. 2 while Performing Machining Operations

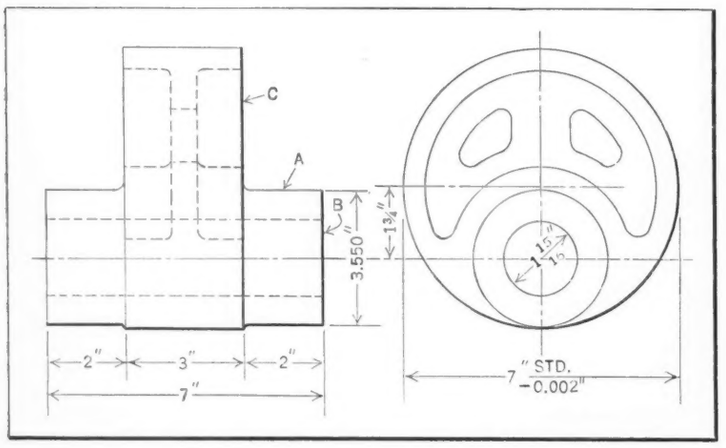


Fig. 2. Eccentric Held in Chuck Shown in Fig. 1 while Boring, Reaming, and Facing Operations are Performed

cient clearance, as all the castings come within this limit. The rough side of the eccentric rests against the hardened heads of the three screws *E*, where it is held by means of the special clamp *F*. There are three hardened steel pins *G* in clamp *F* which project about 1/8 inch and serve to equalize the clamping strain. The special nuts *H* are turned down to fit loosely in a counterbore in the clamp so that they will not project beyond the finished side of the eccentric where they might strike the tools. The three set-screws *J* are used as drivers.

The boring-bar is piloted in the bushing *K*. After the hole in the eccentric has been bored and reamed, it is used for piloting the turning and facing heads. The opening *L* is provided for chip clearance, and the milled opening at *M* is for checking the width occasionally by means of micrometers. The opening or slot *N* is provided to facilitate the removal of chips.

The second operation consists of turning and facing the other side of the eccentric. Bushing *D* is removed and replaced by another bushing, bored to fit the finished hub. The three points *E* are also removed and the finished surface *C*, Fig. 2, of the eccentric is clamped against the flat face of the chuck. The purpose of the hardened points *E* is to prevent the rough casting from marring the finished surface of the chuck. The facing heads used for the preceding operation are also used for the second operation.

The chuck is made of cast iron, and it has a counterbalance at *O*, Fig. 1. Three slots *P* are cast in the back of the chuck to provide clearance for the chuck jaw seats. The chuck is centralized on the machine by means of the pilot *R*. The hubs are turned to the close limit specified for locating purposes only, it being necessary that they be a good fit in the fixture used for holding them while performing the turning and crowning operations described in May, 1931, MACHINERY, page 679.

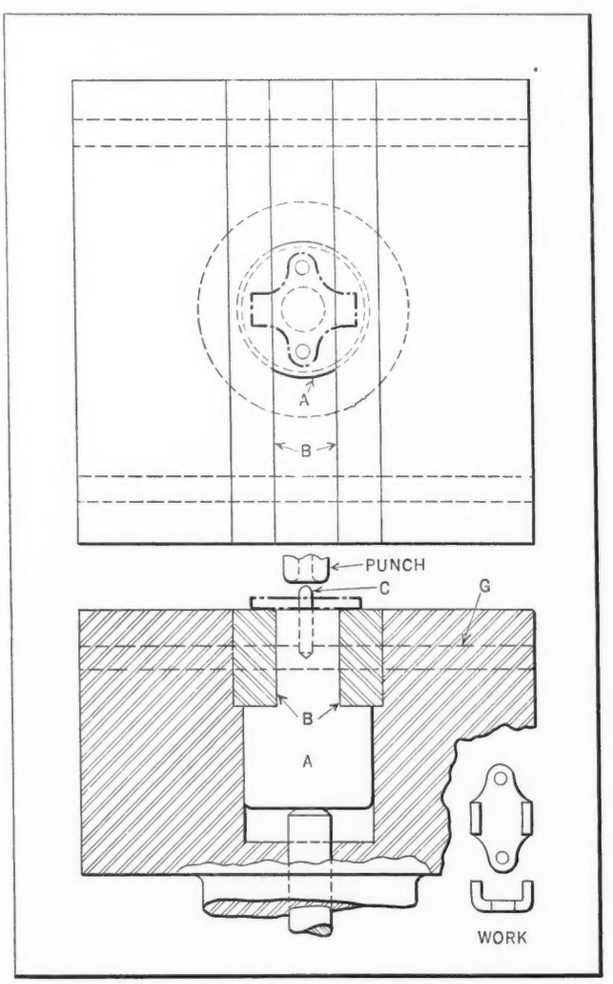
It is necessary to hold only one hub of the eccentric to close dimensions; but as the tools are all set, it is an easy matter to hold the second hub to the same size. Thus either hub can be used for locating the work. After the crowning operation is performed, the eccentrics are forced on their shafts and each journal or hub is finish-turned on centers to a diameter of 3 1/2 inches.

Simplified Forming Die Construction

By J. E. FENNO, Belleville, N. J.

The construction and maintenance of ordinary forming dies may be greatly simplified by using a design like that shown in the illustration. In this die, two bends are made on the part, as shown in the detail view. In order to understand the ease with which a die of this type can be made, the different steps in its construction will be described.

The outside of the die housing and the holes in the shank are machined in the usual manner, after which the hole for the pressure-pad *A* is bored. A straight plug is now turned and pressed into this bore until the upper end is flush with the top of



In this Die, the Slots for the Forming Rails and the Sides of the Pad are Milled Simultaneously

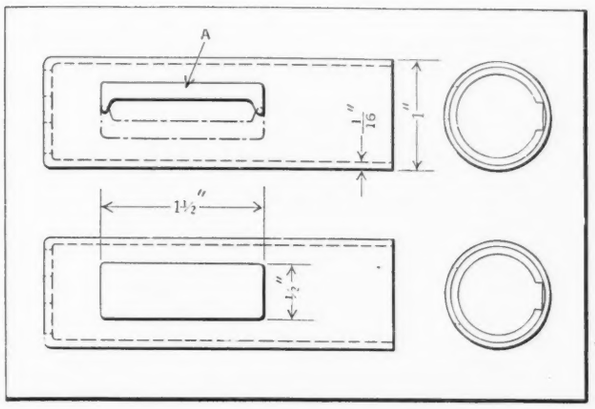


Fig. 1. Shell in which a Wide Slot is Pierced by the Use of Two Dies

the die housing. The plug is made shorter than the depth of the bore, and hence it is necessary to make up the difference with a block; otherwise, the subsequent milling operation might force the plug down further into the hole.

With the plug in place, the housing is set up on a milling machine table and two slots are milled for the forming rails *B*. After this is done, the plug is removed from the bore. The forming rails are now pressed into place and drilled for the dowels *G*, after which the flatted portion of the plug is filed until it is a slip fit between the rails. The rails are now removed and plug *A* is filed again until it is a slip fit in the bore of the housing. Before the rails are replaced again, the pad is drilled for the pilot-pins *C*, and both rails and pad are hardened. After the hardening operation, they may be assembled permanently in place.

The parts enclosed in the housing shank are of the usual design, and for this reason are not shown. It is obvious that, with this design, as the rails wear they can be easily replaced. This method of making the pad and the rails is standard construction in one large plant manufacturing electrical switches. The method of constructing progressive dies here described is economical and also simplifies the maintenance, which is always expensive in dies of this kind.

Horning Dies for Piercing Wide Slots in Tubes

By EUGENE L. SOLTNER, Tool-room Foreman
Mitchell Specialty Co., Holmesburg, Pa.

Piercing wide slots in tubing or shells having small diameters presents one outstanding difficulty, and that is the weakening of the die due to the large amount of metal that must be removed from the center to form the die opening. This difficulty has been largely overcome in the horn die shown in Fig. 2.

In this die, one-half of the rectangular slot in the shell shown in Fig. 1 is blanked at *A*, and the other half of the slot is blanked in a similar die of opposite hand, with a punch having a contour indicated by the dot-and-dash lines. In each die the shell assumes a different angular position on the horn *B* (Fig. 2). These positions are controlled by the key *D* entering a keyway in the end of the shell. The variation in the angular positions governs the width of the pierced slot.

With this arrangement, the width of the die openings is a great deal less than the width of the finished slot, allowing thicker die walls, which have less tendency to spring away from the punch. In both dies, the horn is supported and centered at the overhanging end by the block *C*. This block serves also to force the shell snugly against the die shoulder and can be swung out of the way to permit the loading and unloading of the shells.

In the final operation, all shearing is done on one side of the punch. This causes crowding of the punch to one side, but this effect has been offset by grinding shear on both sides of the punch as indicated. Ground thus, the point of the punch enters the die first, so that the punch is accurately aligned during the remainder of the shearing stroke.

Dies of this type in operation in one plant over a period of eighteen months have given a steady production of about 150,000 shells per month.

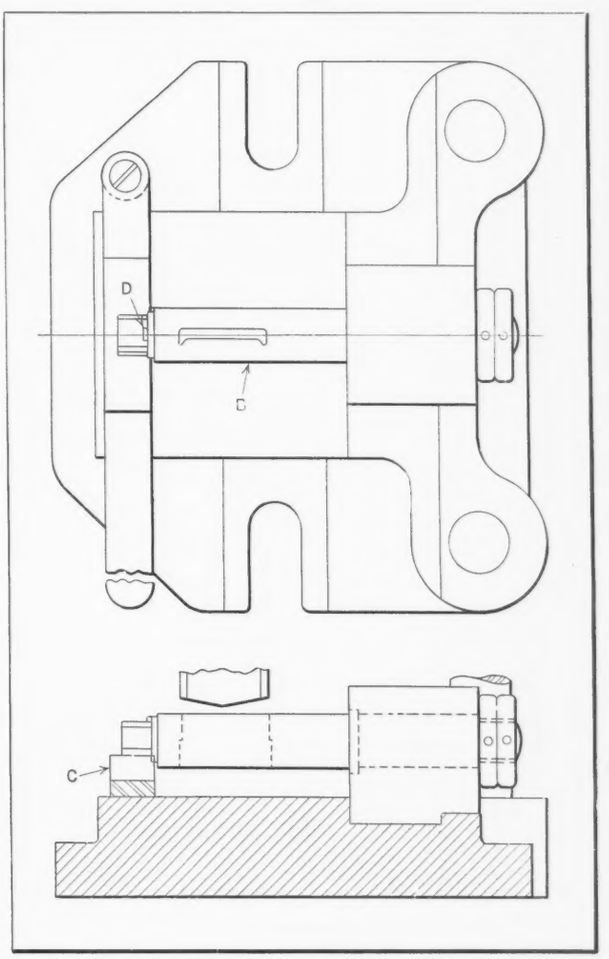


Fig. 2. Horning Die in which Angular Position of Shell Determines the Width of Slot Pierced

Semi-Automatic Fixture for Cutting Off Thin-Walled Tubing

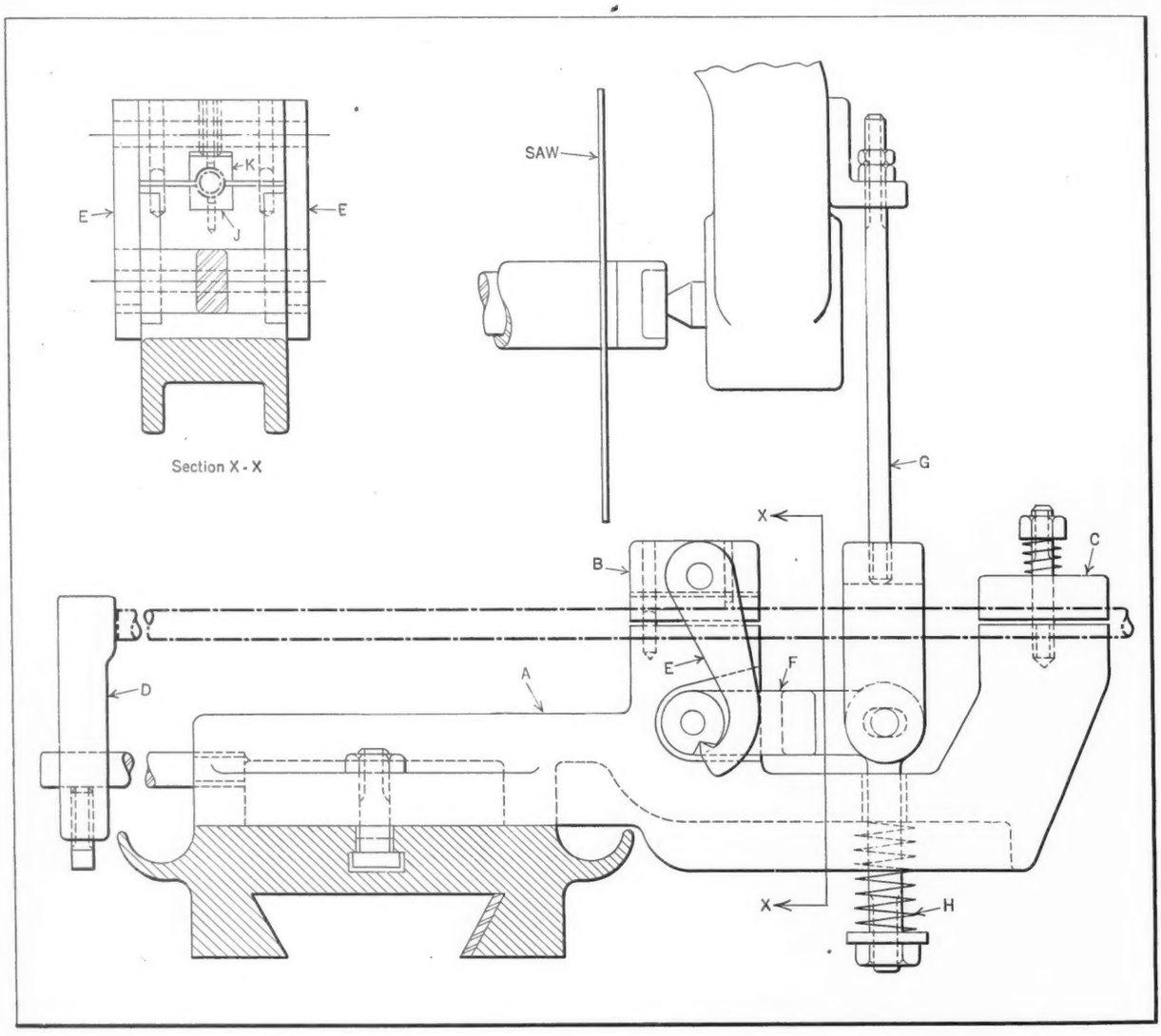
By F. E. JUDSON

In cutting off brass or copper tubing having thin walls, ordinary vise jaws cannot be used, as the walls of the tubing would collapse under the clamping pressure. This condition may be avoided by the use of a fixture designed as shown in the illustration. It is intended for use in conjunction with a hand milling machine, and one of its interesting features is the arrangement for clamping and unclamping the tube automatically.

This fixture consists chiefly of the cast-iron base *A*, bolted to the machine table, and the automatic clamping jaw *B*. In operation, the tubing to be cut off is slipped through the guiding end of the fixture at *C*. A spring-actuated cap at this point produces enough pressure on the tube to prevent vibration during the cutting-off operation. The tube is finally passed between the clamping jaws and against the adjustable stop *D*, which is set for the proper length of tubing. When the tubing is being fed to the stop, the vertical sliding head of the hand miller is in its upper position, and through the levers *E* and *F* and the rod *G*, the upper clamping jaw *B* is held in the released position.

By moving the cutter downward, the upward pull on rod *G* is released and the coil spring *H* forces the right-hand end of lever *F* downward. The motion of this lever, in turn, carries levers *E* and member *B* downward, thus producing the required clamping pressure on the tube. Upon continued downward movement of the sliding head, the tubing is sawed off. Then the head is elevated to the upper position and the lever *F* is raised against the action of the spring *H* enough to release the tubing so that it can be slid along to the stop.

With this method, these tubes can be cut off very rapidly, as the operator need not remove his hand from the lever that imparts the vertical movement to the sliding head. The other hand is employed



Hand-miller Fixture with Automatic Clamping Means, for Cutting off Thin-walled Tubing

for feeding the tube to the stop. The cross-section of the clamping arrangement is shown in the upper view. In order to compensate for wear of the jaws and to adjust the clamping pressure, hardened steel inserts *J* and *K* are incorporated in the design. The upper insert is backed up by set-screws for making the adjustment. One advantage resulting from the use of these inserts is that they may be made interchangeable so that different sizes of tubing can be cut off.

Adjustable Perforating, Cutting-Off and Forming Die

By C. W. HINMAN, Tool Designer
Kobzy Tool Co., Chicago, Ill.

The die shown in the plan and elevation views, Fig. 1, and the end view, Fig. 2, is used to produce eighteen pieces similar to the one shown at *W*, Fig. 2. These pieces, however, are of different lengths and require different spacing of the pierced holes. The cam-like plate *D*, Fig. 1, is the stop which determines the length of the different pieces. This plate can be swung about the stud *E* and indexed to any one of eighteen different positions by inserting a 3/16-inch plug in the bushing *M* and into one of the eighteen bushings in the spring pad *F*.

The piece of work, shown by the heavy dot-and-dash lines at *G*, is located against the stop-plate *D*, after which it is cut off by punch *H* and formed to a right angle by punch *I*. The punch *J* is held in a fixed position, as the holes pierced by it are all the same distance from the end of the work.

The punches *K* and *L* and their die members are held in blocks which can be quickly positioned at different distances from the punch *J* by means of bushings *R* and hardened plugs. Punch *L* can be located in either one of two positions to suit the two different spacings required for dimension *B* indicated in the upper left-hand corner of Fig. 2.

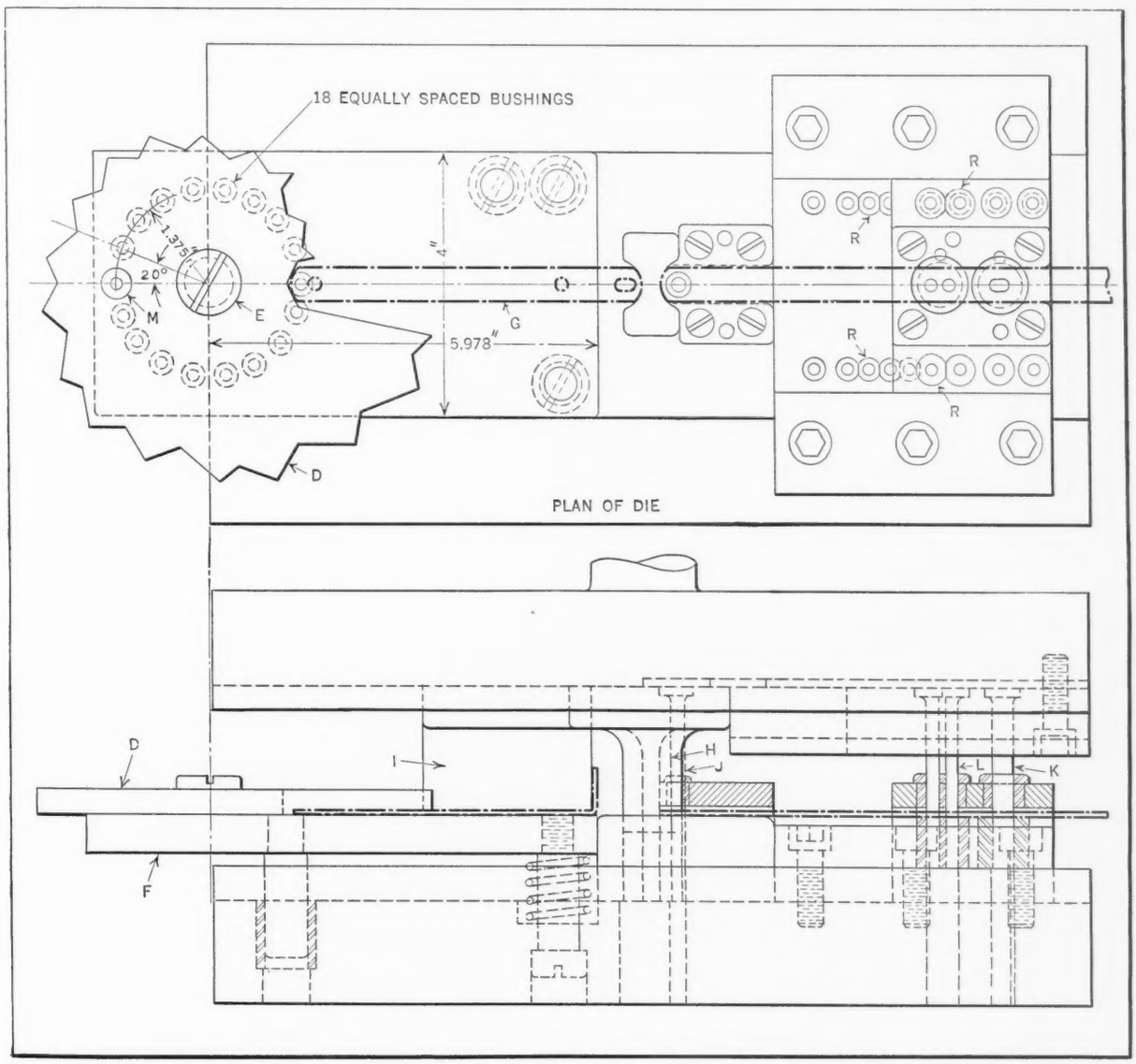


Fig. 1. Die with Adjustable Stop and Punches for Producing Eighteen Different Brackets

With the adjustable features described, it is possible to produce any one of eighteen pieces having different dimensions *A*, *B*, *C*, and *L*, Fig. 2.

Before making the die, a table of eight columns was compiled which gave the dimensions required for the different pieces. Reading from left to right, the eight columns of this table gave the following information: The part number, the number of the indexing hole on plate *D*, Fig. 1, the dimension *A*, Fig. 2, the difference in length of each stop on plate *D* and the length of the succeeding stop, the dimension for machining each stop on plate *D*, dimension *B*, dimension *C*, and the length *L*. Another table was prepared which gave the part number and the numbers of the locating bushings *R*, Fig. 1, to be used in positioning the adjustable punch- and die-blocks for each piece. The locating bushings *R* were of the commercial type, purchased outside the plant, and were hardened and ground ready to be inserted in the holes, which were accurately located on a Swiss boring machine.

It will be noted that all the piercing punches are guided by bushings and that a positive channel type stripper plate is employed. The forming punch *I*, shown also in the detailed view, Fig. 2, has a channel extending its full length, which serves to hold the work straight while forming. This punch was made a little shorter than the length *A* of the shortest piece to avoid interference with plate *D*. The sides of the cutting punch enter the die about 1/4 inch before the punch severs the stock.

The height of the cutting punch is such that the forming operation occurs the instant the stock is severed. When the face of the cutting punch is ground, a similar amount is ground from the top of the forming punch, in order to maintain the proper relationship between the lengths of the forming and the cutting punches. The pressure plate *F*, Fig. 1, has four aligning pins which slide in fixed bushings in the die-shoe, and it is held in place by six retaining screws fitted with helical compression springs. The die described is used on an inclined press having an automatic roll feed. The finished parts roll off the die when released.

* * *

Nothing material has been destroyed. Our natural resources and national wealth are unimpaired. . . . Our capacity to produce, in most lines, more than the current demand is not a cause for concern; but the taking up of this slack seems to me to be the first job to be done. In spite of so-called hard times, there still remains a great volume of business for those who want it hard enough to go after it, and who are not afraid of new ideas and new methods. New ideas create new wants and junk old standbys. The novelties of yesterday, such as the automobile, radio, and electric refrigeration, are the staples of today. In the same way, today's novelties will become the necessities of tomorrow. —*A. W. Robertson*, Chairman of the Board, Westinghouse Electric & Mfg. Co.

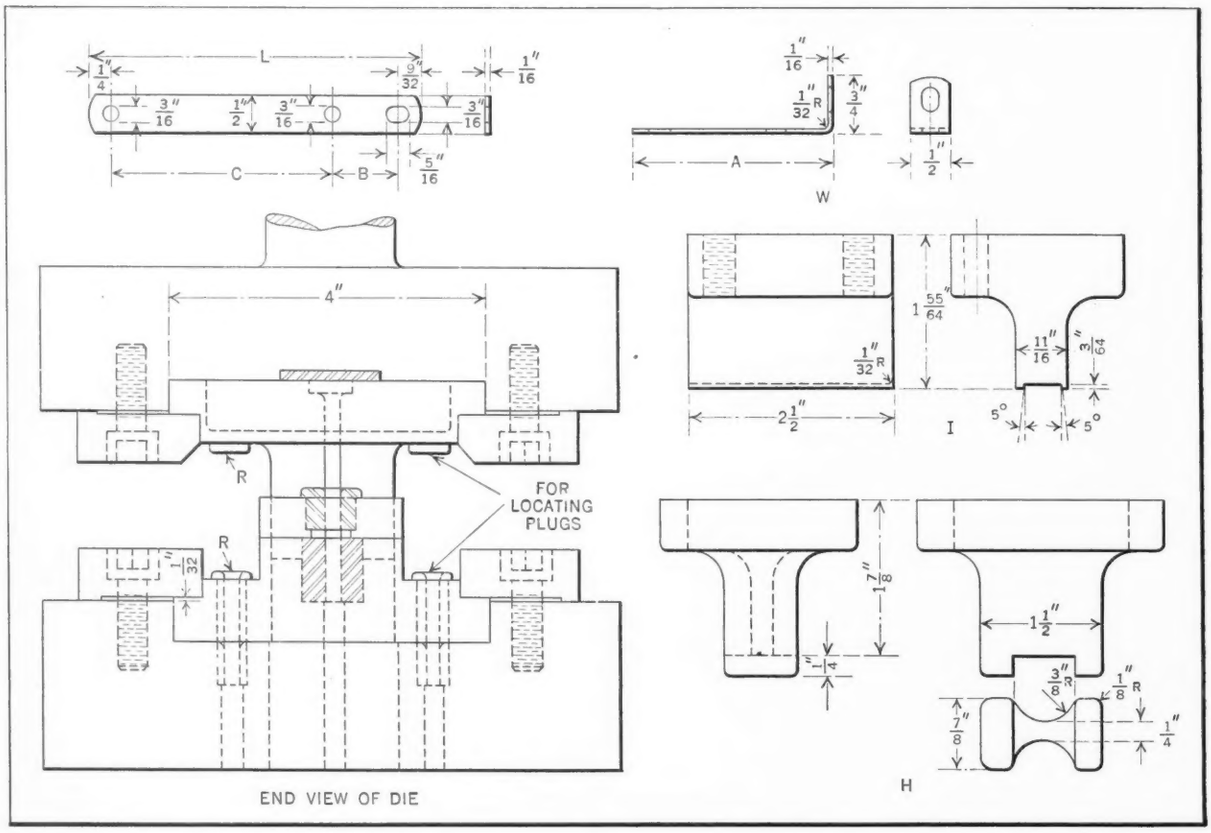
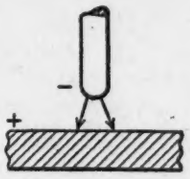


Fig. 2. End View and Details of Die Shown in Fig. 1

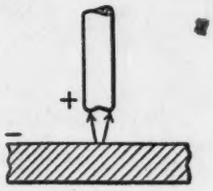
MACHINERY'S DATA SHEETS 221 and 222

ARC-WELDING INSTRUCTIONS*—3

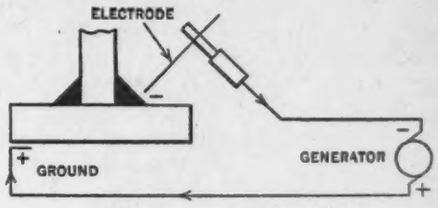
Length of Welding Arc and Connection to Generator for Straight and Reverse Polarity



(18) Straight polarity. See (20) and (22)



(19) Reverse polarity. See (22)



(20) Connection to generator for welding with straight polarity. See (22)

(21) A short arc must be maintained consistently, the length being kept about equal to the diameter of the rod used. A short arc prevents absorption of oxygen and nitrogen by the hot metal, the absorption of the oxygen creating oxides and the creation of nitrides causing brittleness of the iron. The short arc gives better penetration. With a long arc, too large an area is covered by the unsteady arc to secure penetration.

(22) Work requiring reverse polarity, as at (19), will alternate with jobs that can be welded only with straight polarity, that is, with the plus side of the line connected to the work as at (18) and (20). The polarity can be checked readily with a graphite electrode, the carbon end becoming blunt, and the arc, in the shape of a pronounced cone, appearing to start from the carbon as at (18), with straight polarity. With reverse polarity, a crater is formed in the carbon as at (19), and the arc appears to start from the work and is more difficult to maintain. A metal electrode is melted faster with reverse polarity. A crater in the work is formed only when straight polarity is employed with either type of electrode.

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*Based on data in a paper read before the American Society for Testing Materials by R. Kraus of the Westinghouse Electric & Mfg. Co.

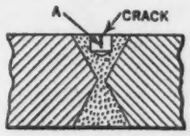
MACHINERY'S Data Sheet No. 221, New Series, March, 1932

ARC-WELDING INSTRUCTIONS*—4

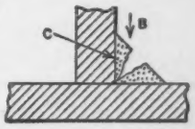
Methods Employed in the Inspection of Arc Welds

(23) Under-cut on vertical side wall is indication of penetration. See (27)

(24) Deep under-cut in both walls indicates excessive current for size of arc used. See (28)



(25) A 1/2-inch hole drilled in a weld to verify existence of crack *A*.



(26) Section of weld burned away with torch preparatory to melting metal away at *B* to determine if poor fusion exists at *C*. See (29)

(27) The under-cut shown at (23) must be slight and should appear more like a shadow line. On the horizontal plate, the molten material covers the under-cut or dividing line between the molten parent metal and the portion that remains solid.

(28) Lack of fusion will show up in extremely bad cases of excessive under-cutting, as at (24), when the material cools, the contact of the welded metal causing the base of the filler to pull away from its seat on the parent metal to which it is fused. This condition is more likely to occur in corners subject to "magnetic blow"; such defects can be noticed by accumulations of iron particles along a clearly defined line, due to the magnetism created in the steel during the welding operation. If this evidence is obliterated by brushing or shot blasting, it can be easily reconstructed by blowing iron dust against the suspected area. The same method can be used in locating suspected cracks. As the two sides of a fissure are of different polarity, they attract the particles. Cracks may be visible to the naked eye or when using a good magnifying glass. If a hole is drilled as at (25) on what appears to be a hair crack or fine ripple in the surface, the existence of a crack will be shown if a clear line appears at *A*.

(29) If difficult to judge penetration because of slight overlap, burn out the weld as at (26); then melt material away, beginning at point *B*. The last layer will curl up like a sliver, the heat not being transferred to the piece when fusion is missing, due to a layer of trapped slag. The curled-up layer will reveal the black appearance of the parent metal. If we cut through a weld to separate a section and the section can be lifted out to disclose the black appearance of the parent metal, it is obvious that the materials have not been fused together.

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*Based on data in a paper read before the American Society for Testing Materials by R. Kraus of the Westinghouse Electric & Mfg. Co.

MACHINERY'S Data Sheet No. 222, New Series, March, 1932

Supplying Lubricants to Bearings

Economies Can be Effected by Standardizing the Lubricating Devices Used on Machines and Shop Equipment

By G. L. SUMNER, Oil Engineer
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

ONE of the most important points in the economical lubrication of machinery is the method of feeding the lubricant to the various bearing surfaces. No matter how much thought is given to the testing and selecting of lubricants, there is little hope of obtaining low maintenance costs unless the lubricants are properly applied.

The Standardization of Lubricating Devices has Reduced Oiling Costs

The non-uniformity in devices used to introduce lubricants into machines is surprising, even in some of the best equipped plants. The reason for this condition is that the builders of machinery make little attempt to standardize on lubricating appliances. There are many reasons why the standardization of lubricating appliances in a large plant on machines already installed is not an easy task, but savings can be effected through this work.

In one department where the adoption of standard lubricating devices has been only partially accomplished, three oilers working full time have been adequately replaced by one man. As an example, the replacement of ordinary sight-cups on a large power press by bottle-type oilers similar to those shown at *A* in Fig. 1 reduced the need for filling the cups from twice a day to once every ten days. There was a corresponding reduction in the amount of oil consumed.

The automatic lubricator *B*, Fig. 1, is another satisfactory oiling device, provided its fittings have an adequate lead to the bearings. It functions only when the machine is operating, which is also a feature of the bottle oiler.

The first step in standardizing lubricating devices on machines already in service should be to study the various devices on the market. This study may be best accomplished by a committee selected from various sections of the plant and the engineering and purchasing departments. The advantages and disadvantages of the various devices should be determined, taking into consideration the conditions under which the devices must function. The diversified requirements of the different departments should also be kept in mind in an attempt to meet the needs of the majority.

Devices should be selected tentatively and tested in the several departments. Reports and discussions relating to these devices will be helpful in reaching decisions. After an agreement has been reached, it is equally important that section foremen cooperate with the committee in removing inadequate or wasteful devices and replacing them with the recommended lubricators. After standardized devices have been decided on, they may be specified on the machines purchased or the machines may be bought with lubricating devices omitted and then be equipped when they are received.

The Tests on Lubricators Should be Severe

To test a lubricator properly, it should be used on equipment offering the greatest difficulty. For instance, the bearings of two fuel-oil pumps, such as shown in Fig. 1, when lubricated by means of hand-cups, had to be rebabbitted twice a year. Since providing the bottle oilers and automatic

George Lewis Sumner, oil engineer of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., received his preparatory education at the St. John Military School, Manlius, N. Y., and his B. S. in chemistry at Penn State College in 1914. After graduation, he was first employed as chemist with the Illinois Steel Co., Gary, Ind. A year later he was engaged in a similar capacity with the National Tube Co., McKeesport, Pa. In 1917 he became a chemist with the Westinghouse Electric & Manufacturing Co. In 1923, Mr. Sumner was appointed materials engineer on insulating, lubricating, and fuel oils, and oil purifying equipment, which is the position he now holds.

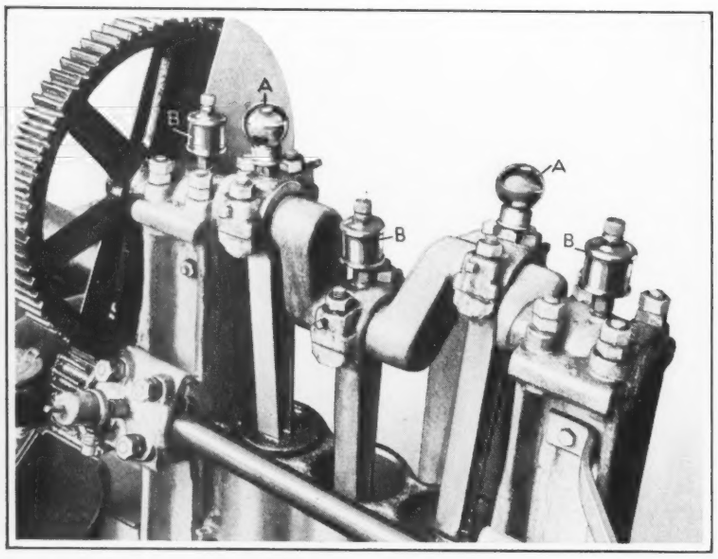


Fig. 1. Bottle-type and Automatic Lubricators which Function only while the Machine is Operating

lubricators, the indications are that these pumps will now run three or four years without the bearings needing attention. Reduced oil consumption is another advantage. For use on bearings requiring infrequent oiling or when automatic lubricators cannot be readily installed due to the interference of machine parts, it is usually desirable to stock a quantity of small oil-hole cups having a cover.

Three General Methods of Grease Lubrication

In all industrial plants there is equipment best lubricated with grease, although in many instances oil-fed automatic lubricators will replace grease devices economically. Three general types of grease devices can usually be made to cover the needs—namely, small compression cups loaded by means of a pressure gun; a one-shot system piped to the bearings from a reservoir operated intermittently by pressure; and a pressure system in which the grease is forced constantly to the various parts of the machine.

Compression cups having standard Zerk or Alemite fittings are primarily suited for relatively small machines or machines that cannot easily or economically be greased under pressure. One-shot and constant-pressure systems can be used to advantage on large machines. Grease feeds should be carefully regulated to avoid waste and excess grease about the machine. Since the room temperature of the shop varies seasonably, grease feeds should be adjusted at least twice a year in order to get the best results.

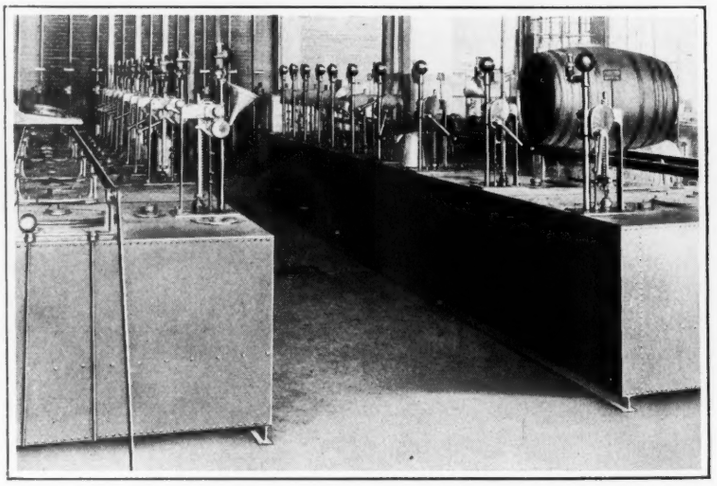
Compression grease cups are especially suitable for the bearings of mixing or screening machines, sand conveyors, etc., that are subjected to dust, dirt, and fine abrasive materials. On such equipment, grease has the advantage over oil in that it forces the old lubricant out of the bearing and thereby prevents the introduction of abrasive particles into the bearing surfaces. There are other applications for grease, of course, such as the lubrication of ball and roller bearings and worn bearings that would permit oil to flow through between the bearing and shaft without adequately lubricating them.

How Oils and Grease Should be Stocked

The preferable methods of buying, storing, and handling oils depend upon the quantities in which they are purchased. Few industrial plants use lubricating oils in sufficient quantities to warrant their purchase in tank cars, at least in more than one or two grades. Obviously, the purchase of oils in tank-car lots involves a high initial investment, interest loss on the investment, depreciation if the stock is not readily moved, and the labor cost of barreling and distributing. This method also requires a large storage space. The low price per gallon, as compared with drum shipments, is of decided advantage, however, and with a rapidly moving stock, considerable savings can be made by purchasing oil in tank-car lots. Even greater economy can be effected if the oil can be piped to the points of greatest consumption.

In general, it is undesirable to stock large quantities of oil in individual departments on account of the fire hazard from oil-soaked waste and spill-

Fig. 2. Economical Method of Storing Oils when the Quantity of the Different Kinds is not Large



ing. In departments where drum lots are required, adjustable spigots may be screwed into the bungs to facilitate drawing. When only small quantities, say 5 or 10 gallons, are needed at a time, safety cans having a spring cap are desirable. They have the additional advantage of protecting the oil from dirt and dust.

A convenient method of stocking and handling oil in the main oil house is by means of storage tanks located in the basement. Hand- or motor-operated pumps on the main floor will provide a centralized means of distribution. When the volume of oil used is not large, small tanks on the main floor, as illustrated in Fig. 2, will be found convenient.

Care should be taken to keep grease barrels covered, as there is always danger of contamination with open barrels. Then, too, contamination may result from using the same paddle on different grades of grease when filling shop orders. Owing to this, it is often advisable to purchase grease in small packages, although savings may be made by buying it in barrel lots. Obviously, when skilled labor is used, it is important to take advantage of this saving. No set rules can be laid down to cover the best procedure for all plants to follow in the purchase, storage, handling, and use of lubricants.

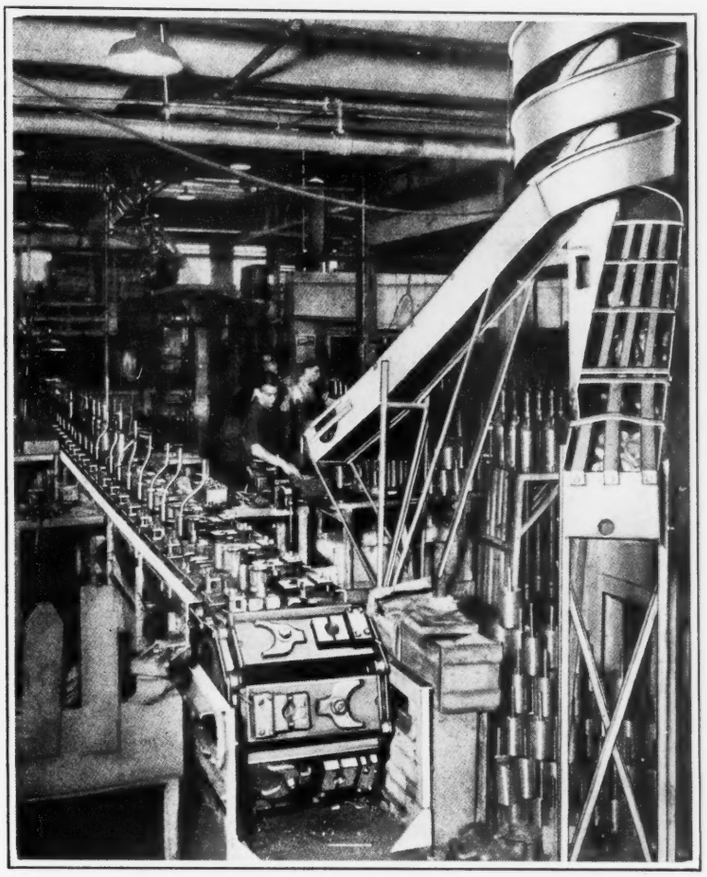
[Articles by the same author, entitled "Selecting the Right Lubricant," and "Determining the Properties of Lubricating Oils and Greases," appeared in January and February MACHINERY, respectively. —EDITOR]

* * *

According to *Commerce Reports*, the annual consumption of ball and roller bearings in Germany is estimated at $20,000,000, of which over 90 per cent is supplied by domestic manufacturers.

Fixtures on Conveyor Pallets Speed Up Assembly Work

Pallet or apron conveyors are used extensively for assembly operations in the metal-working industries, because they provide a continuous moving platform on which the work can be placed solidly. The pallets may be arranged with short gaps between them or they may be of an interlocking design in which such spaces are eliminated.



Fixtures Fastened to the Pallets of This Conveyor Facilitate Assembling Oil-pump Heads

In the accompanying illustration is shown a pallet conveyor that is of more than customary interest because of the fact that assembly fixtures are mounted on each pallet. Thus the main parts to be assembled, which are delivered to the conveyor by the spiral chute at the right, can be securely clamped in a convenient position and the various other units can be added as each pallet progresses toward the far end of the conveyor.

This conveyor was installed by the Mathews Conveyor Co. in the plant of the Fry Equipment Co., Rochester, Pa. It is employed in assembling the heads of pumps used on the portable oil carriages seen in garages and service stations, but similar installations could, of course, be used for assembling various other kinds of work.

* * *

Our era is one particularly noted for its quests for information. We have commissions and committees and institutes galore gathering information and submitting reports. The sad thing about it all is that the report, after it is "submitted and accepted," is too often forgotten. No action follows —we keep on in much the same way as we did before. What the world needs right now is less reporting and more constructive action.

Obsolete Traditions in the Drafting-Room

An Examination Into Drafting-Room Methods, and a Questioning of the Efficiency of Some of the Traditional Practices

By J. S. DRAGO

IN an article published in February MACHINERY, page 415, the author discussed the subject of drafting-room standards, pointing out that the lack of a universal standard for the making of drawings is a great hindrance to the draftsman. The present article will consider an even greater obstacle to the draftsman's work—the obsolete traditions of the drafting-room.

Outstanding among these traditions is the belief that every finished drawing must be a perfect picture. Another tradition is that at least two views of the object must be shown, whether they are necessary or not. Still another is that ordinary handwriting of any sort on a finished drawing is a serious error. There are many others, all along the same line—to cause the draftsman to concentrate on the making of the drawing, instead of on the design of the object that is being drawn.

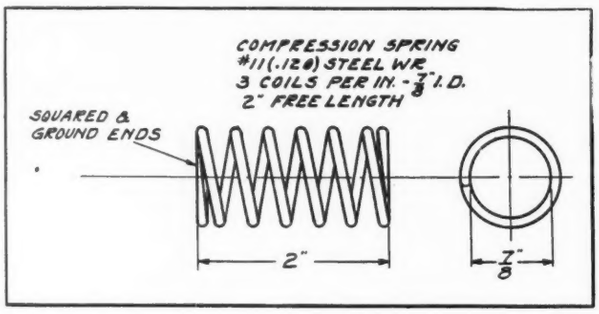


Fig. 1. A Conventional Drawing which Could be Replaced Satisfactorily by Written Instructions

Take, for example, a coil spring. Generally, it is drawn as shown in Fig. 1. The draftsman must hold his breath while scribing the little arc that represents the outside of the wire, and then he must print the notes. He may spend an hour straining his eyes and wrinkling his brow; yet, if he were to omit the drawing of the spring altogether, he might write in a clear hand all the necessary instructions in two or three minutes. The picture of the spring and the precise printing are both superfluous, but they take probably 90 per cent of the time. Even pulleys and simple spur gears can be specified without a picture.

All that is Really Needed is that a Drawing Should be Clear and Legible

Clearness and legibility are all that is required of any finished drawing. If a draftsman can be trusted to use his judgment in designing a machine or in choosing the information required by the shop man for making it, he ought to be able to judge when he must use stiff precision methods or when a free-hand sketch would be good enough.

In the drafting-room of a leading manufacturer of coffee machinery, finished drawings are made only of the standard machines. All other odd jobs, special pieces, experimental parts, etc., are sketched on thin bond paper, to scale or free-hand as may be deemed advisable in each case. The draftsmen are permitted to write or print the notes as they see fit. There are no more errors in reading these sketches than there are in reading the most highly finished drawings. The sketches are filed as permanent records, the same as drawings.

Why is writing on a permanent drawing considered out of place? Can you imagine anyone suggesting that the bookkeeper print as a draftsman does, instead of writing in his entries? If the bookkeeper can write his thousands of items in the cramped spacing of his books and can use all sorts of abbreviations without anybody having difficulty in reading his records, why is it not logical to assume that ordinary handwriting on at least simple drawings is both feasible and advantageous? Anyone can acquire the knack of writing a legible hand quicker than to print notes rapidly and well.

The essential features of the part shown in Fig. 2 are drawn to scale; the unimportant ones are made free-hand. In most drafting-rooms, this sketch would not be accepted as a finished drawing; but what information does it fail to convey? Why could not 80 per cent of all drawings be made in this manner, while only 20 per cent would be made in the elaborate style meeting all the requirements of mechanical drafting?

The Physical Work of Drafting Should be the Least Important of the Draftsman's Efforts

All these suggestions are not made solely with a view to reducing drafting time. There is a more important reason. The ideal arrangement of designer, detailer, and tracer exists in very few places. The vast majority of mechanical draftsmen are simultaneously designers and detailers, and quite often tracers as well. We have, on the one hand, an intelligent, well educated man whose work and interest are concentrated on the development of machine equipment; on the other hand, we find that in the course of his work he must spend half of his time making pretty pictures and learning a new system of drafting almost every time he may have to change his job. Can a man, hampered by such details, retain his interest in his work?

An alert draftsman wants to—and should—keep constantly in mind the shop's problems in making and assembling what he is designing. He also keeps in mind how it looks on the salesroom floor and how it operates in actual use. But if he can give to these important considerations only half of his attention, while the other half must be concentrated on what might be called the typographical details of drawing, his production is bound to suffer—production in this case meaning, of course, his contribution toward the finished machine, not the appearance of his drawings.

Is the Man that Makes the Finest Drawings the Best Designer?

The more a man must consider the appearance of drawings, the more clouded is his view of the real objective. Some draftsmen seem to like to produce "nice" drawings, but observation will show that these men are, as a rule, mechanically inefficient and mentally slow. They find it easier to pamper a drawing than to think.

The excessive refinement in the execution of drawings causes not only loss of time but loss of those intangible factors—patience, alertness, and perspective—which are by far the most important in producing a proper design for a finished product.

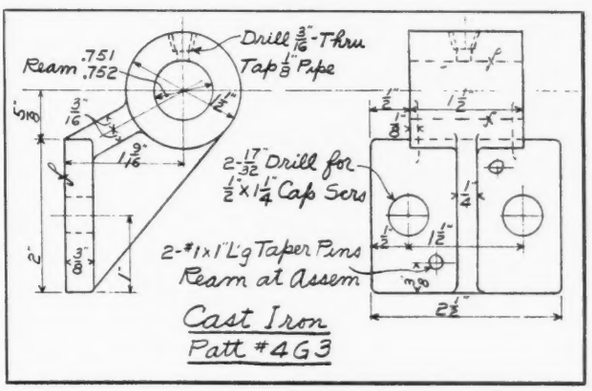


Fig. 2. A Drawing that is Partly Freehand and has Written Notes Instead of Printed Ones

Some men contend that the appearance of the drawing affects the quality of the shop man's work. This is a vague theory. The shop man cares less than anyone else how a drawing looks. What he expects from the drawing is information, not art.

Inefficiency is No Cure for Unemployment

In these days of unemployment some one may argue that the simplification of drafting work will cause unemployment among draftsmen. The answer is: "No, it will not." More bookkeepers are employed today than before the introduction of the adding machine. Countless similar instances could be cited. The draftsman cannot hope to insure his job with inefficiency any more than the rest of the world can hope to regain prosperity by refusing to use labor-saving machinery.

To keep step with the other departments of industry, drafting work must move in a quicker tempo. If the draftsman wants to increase the value of his time, and the manufacturer wants to get more economical production from the drafting department, drafting-room practices must be thoroughly simplified and standardized.

The committee of the American Society of Mechanical Engineers that is now working on drafting practice improvements should have the cooperation of everybody connected with drafting work. In the meantime, let us keep in mind that the mechanical draftsman's job is to produce machine equipment; the instructions for making it and the drawings are only incidental.

* * *

Salvaging Metals from Ashes

Savings of approximately $16,000 a year are realized by salvaging metals from ashes produced in the scrap incinerator at the Schenectady plant of the General Electric Co. The ashes, instead of being loaded into a dump car and delivered to the dump, are first run through a ball mill, where they are pulverized, the larger pieces of metal passing out of the mill and over a magnetic separator, which separates the magnetic scrap from the non-magnetic material, which consists of copper, brass, aluminum, etc.

The finer material which is discharged from the ball mill passes over an inclined, longitudinally grooved "concentrating table," which has a stream of water flowing crosswise of the material. The metal parts, being heavier than the ash, slide down the bottom of the grooves and fall off the lower end of the table, while the ash is washed off the side of the table and is then pumped through a "dewatering cone" which discharges the dewatered ash in a dump car. The metals and concentrates are sent to the smelter or sold as scrap. By this method from 20,000 to 25,000 pounds of metals and high-grade smelting material are recovered each month.

* * *

Dr. Nicholas Murray Butler, president of Columbia University, recently commented on the prevalent lack of economic vision on the part of business leaders, and recommended a brushing up on the writings of Henry George, who, during the depressions of the seventies and nineties, indicated clearly some of the fundamental causes of business depressions. Dr. Butler, while not endorsing completely all that Henry George said, asserts that his writings throw an illuminating light on much that is mysterious about business depressions, and points to him as one of the greatest economic thinkers of all time.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that have been Found Useful by Men Engaged in Machine Design and Shop Work

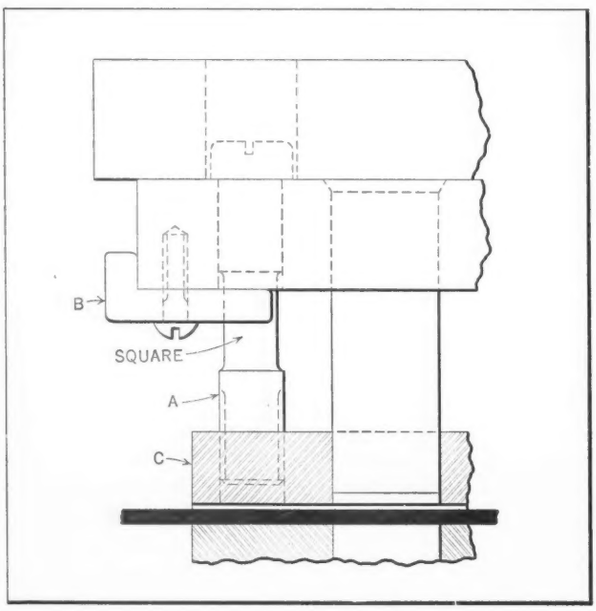
Raising the Stripper Plate to Align Punch and Die

In order to align a punch and die equipped with a spring-actuated stripper plate, the stripper plate must be raised and held so that the end of the punch will extend below the plate. With the arrangement shown, the writer has provided a means not only of doing this, but also of leveling the stripper plate and locking the guide screws to prevent them from rotating while in operation. One of the guide screws is indicated at *A*.

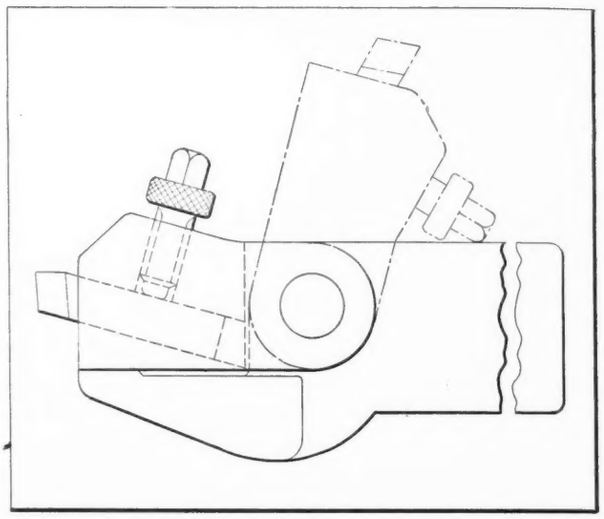
The central portion of these screws is milled square and this square part is a slip fit in the straps *B*, which are secured by round-head screws to the punch-block. To raise the stripper *C*, the straps *B* are removed from the punch-block and the screws are rotated. Incidentally, one of the straps serves as a wrench for rotating the screws. After aligning the punch with the die hole, the plate is lowered again to the position shown and the straps are replaced on the block in the locking position.

Obviously, when the ram descends, the stripper plate will rest on the strip of stock and as the ram continues to descend, the screws *A* will slide upward in the punch-block. The square portion is made long enough to allow for this vertical movement of the screws, thus exposing sufficient surface for the application of the wrench.

Swissvale, Pa. ELLSWORTH E. CLARK



Arrangement for Raising Spring-actuated Stripper Plates to Align Punch with Die



Threading Tool Hinged at Cutting End to Avoid Backing the Tool out of the Thread after Each Cut

Threading Tool of the Hinged Type

In threading work on an engine lathe with the tool illustrated, it is unnecessary to back the tool out of the thread after each cut. The end of the tool in which the bit is clamped is designed so that it can be swung upward to clear the thread when the tool returns to its starting position. A run-out or annular groove must, of course, be provided at the end of the thread so that the cutting pressure at the point of the tool will be released to allow the operator to raise the hinge.

When the lathe carriage is returned to its starting position, the hinged end is swung down into the threading position indicated by the heavy outline. The knurled portion of the clamping screw serves as a convenient handle for swinging the hinge into its different positions.

Dayton, Ohio F. J. WILHELM

Preheating and Washing Metal Parts for Paint Dipping

When metal parts are to be given a coating of paint by dipping them in a tank, it has been found of great advantage to immerse the parts in hot water first. The tank for the hot water is similar in size to the paint tank. The hot water tank is placed in front of the paint tank with a short drip board between the two. By dipping the work in the hot water, the paint in the tank is kept clean so that less benzine is required to keep it properly

thinned. Dirt, grit, and grease are washed off in the hot water tank and a much better finish is obtained.

The clean hot surface obtained by first dipping the work in hot water causes the paint to be baked on, to some extent, so that it is less easily chipped or scratched off. The hot surface also causes the surplus paint to flow off more quickly and, consequently, a coating of more uniform thickness is produced. Thus, the hot washing operation results in a saving in paint and shortens the time required for baking or drying of the dipped work, as the hot surface promotes drying from the under surface of the coating. The water in the tank should be kept near the boiling point, although where very large tanks are used, the volume of boiling water may be sufficient to retain enough heat for the day's run of work without the continuous application of heat.

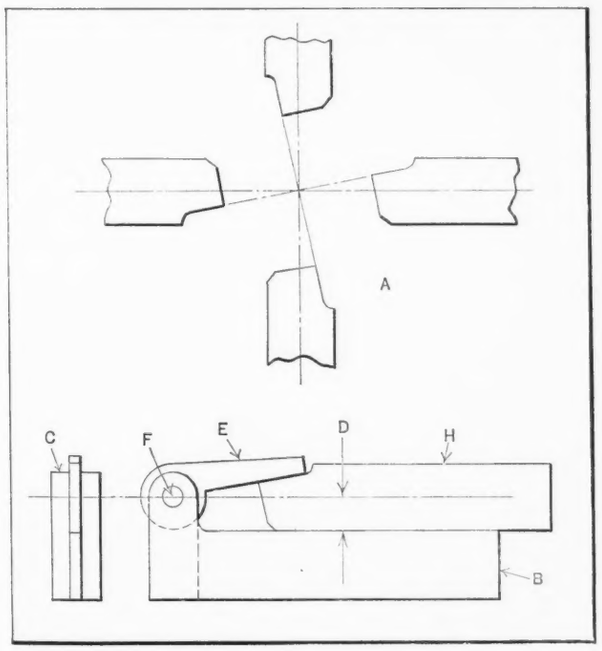
ALFRED SMITH

Gage for Face Angle of Thread Chasers

In the accompanying illustration is shown a gage made by the writer for checking the face angle of thread chasers of the milled type which are positioned in the die-head as shown in the upper view at *A*. The lower view shows how the gage is used in checking the face angle of the chaser *H*.

The blade *E* is free to move or pivot on the pin *F* in the body *B* of the gage. Pin *F* is located a distance *D* from the flat surface on body *B* equal to one-half the thickness of the chaser. With pin *F* in this position, the gaging edge of blade *E* will always coincide with a radial line corresponding to a line passing through the center of the work.

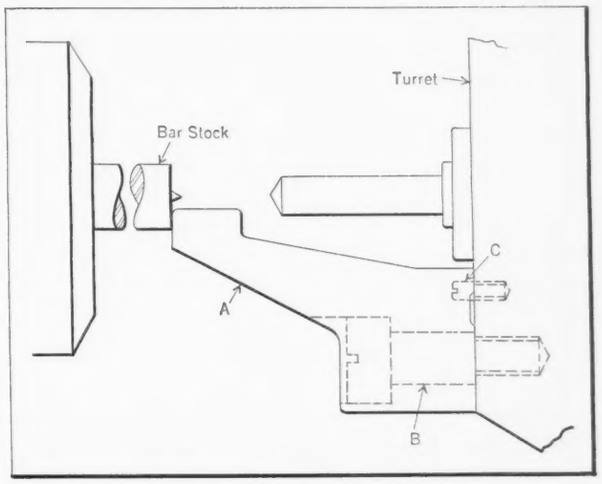
Philadelphia, Pa. EUGENE L. SOLTNER



Gage for Testing Face Angle of Thread Chaser to Insure Correct Alignment of Chasers

Bar Stock Stop for a Turret Lathe

In most cases where bar stock is being turned in a turret lathe, the bar is carried out against a stop secured in one of the turret stations. This makes one less station available for holding cutting tools. The swing stop here illustrated does not interfere in any way with the tooling capacity of the turret. The stop *A* swings about the shoulder screw *B*. In the illustration, the stop is shown in position for locating the bar stock, and resting on the screw pin *C* in the turret face. After the bar has been clamped in the chuck, the stop is swung away from the pin so that it will clear the bar while it is being drilled. This stop can be easily removed from the turret, and the pin *C* can be also removed to allow flanged tools to be used at this station.



Swinging Stop for Turret Lathe which Makes an Extra Turret Station Available for Holding Cutting Tools

Belleville, N. J. J. E. FENNO

Using Compressed Air for Threading Wires through Curved Conduits

Compressed air can be used to advantage in threading wires through long and curved conduits, by placing a string over the conduit and blowing the string through to the opposite end. The wire is then tied to the string, which is used to pull the wire back through the conduit.

Rockford, Ill. W. E. GUNNERSON

* * *

No man who calmly looks at America as a nation can fail to take courage and to gain confidence. A dispassionate view of conditions will give us all faith in the future of American trade and industry, and will convince us all that the answer to many of our immediate and future problems lies in taking the long-time viewpoint and in conducting our operations on the basis of facts and fact finding.—*Frederick M. Feiker*, Director, Bureau of Foreign and Domestic Commerce.

The Shop Executive and His Problems

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

IT is often too costly to provide a fireproof vault of sufficient size to take care of all the tracings in a shop; and when such a vault is provided, it is not often possible to file away the drawings used for reference every night.

The writer has devised a simple plan to preserve a record of all tracings. A blueprint of each tracing is made, and immediately stored away in the vault of the office. These prints need not be filed in a systematic manner, as there is no occasion to consult them, except if the original tracings are destroyed by fire. They may be piled on top of each other in a box or rolled together. Should a fire occur and the tracings be destroyed, the only expense would be to reproduce, from the blueprints, the tracings that are needed for the files.

WILLIAM H. KELLOGG

Marking Steel for Identification

If steel manufacturers could mark steel bars as suggested in the article "Marking Steel for Identification" on page 336 of January MACHINERY, it would greatly simplify the heat-treating procedure.

In our shop, we have made it a practice, for a number of years, to paint each end of every new bar as soon as we receive it, using a different color for different materials. We also paint a stripe of the same color on one side of the bar, and stamp each end of the bar with a symbol.

When we have an expensive tool to make, the cutting-off department slices off a thin section, about 1/8 inch thick, next to the piece that is being cut off for the tool. This disk is then sawed in half, and the hardener hardens half of the disk, after which he breaks it to study the fracture before hardening the finished tool. If there is any question as to the correct temperature, the other half of the disk is hardened. When hardening at intervals, this provides a check on the pyrometers and on the steel, especially as some bars vary in their hardening properties from one end to the other. Incidentally, we have not spoiled a single tool in hardening since this method was adopted.

U. SETH EBERHARDT
Newark Gear Cutting Machine Co., Inc.

I have read with interest the discussion on the marking of tool steel for identification. The proposal on page 336 of January MACHINERY, to have tool-steel manufacturers stamp their product at intervals throughout the length of the bar with a symbol indicating the kind of steel and its heat-treatment does not seem to me to be practicable. Stamping round bars is usually unsatisfactory, and to roll the symbol into the bar would be too costly.

There is always some scale on the bars, which, when struck by a stamp, flakes off, carrying with it some of the stamped imprint. Even if the bars could be successfully marked, the stamping would be on a dark background and could be deciphered only on close inspection.

Painting offers the most ready solution to this problem; but striping alone is not satisfactory, nor is the painting of the ends of the bar. A narrow band of color is likely to be rubbed off. Painted ends will be cut off when the first piece is removed.

I suggest to paint the entire bar with two coats of paint. When I receive a supply of tool steel, I have it cut to convenient lengths for handling and then painted all over, using only bright colors—bright red, yellow, light blue, and green. A color chart is hung in a conspicuous place near the steel storage. This gives each grade of tool steel, the corresponding color, and the correct hardening heat.

In addition to this, every man is instructed to stamp on every machined piece of tool steel a symbol corresponding to the brand, and also the letter "W" or the word "Oil." This indicates whether the steel is water- or oil-hardening.

EUGENE L. SOLTNER, Tool-room Foreman
Mitchell Specialty Co., Holmesburg, Pa.

Checking up on the Efficiency of the Efficiency Engineer

A large manufacturing firm employs several engineers in a department devoted exclusively to improving the efficiency of production methods and to devising new means for improving quality and reducing costs. But even the efficiency department itself must be made to pay. Its production must warrant the expense of investment. Hence, each engineer in the department is required to make a complete report periodically to the works manager. This report shows the savings that have been effected in the plant through the substitution of improved methods that have been initiated by the efficiency department. These reports are then compared with actual cost figures, and in this manner it is possible to determine with considerable accuracy the value of the department maintained for improving methods of production. OBSERVER

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

D. M.—I understand that there is a method used for milling depressions in die-blocks so that an internal square corner is obtained. A pencil mill is used, set at such an angle that it is possible, with one setting, to mill both of the sides that make up the internal corner, and also the bottom of the depression square with the sides. I would like to see this method described and a formula given for setting the milling attachment spindle, as it is obvious that the angle of the spindle and the angles of the sides of the pencil mill must bear a certain relation to each other.

Answered by R. V. Raymond, Brooklyn, N. Y.

The pencil mill is conical in shape, with an included angle of 70 degrees 32 minutes, as will be shown later. The work is clamped in position with the bottom of the depression in a plane parallel with that of the table. One side of the depression that meets the corner to be milled should be parallel with the table slots. A universal milling attachment is used, in which the cutter-spindle can be swung in two different planes at right angles to each other. When positioned correctly, the axis of the spindle should form an angle of 35 degrees 16 minutes with the top of the machine table; and when projected vertically toward the work, the line representing the axis should coincide with a line bisecting the angle (90 degrees) of the corner to be milled. It is now a simple matter to mill the corner square by the use of the vertical, longitudinal, and transverse table feeds.

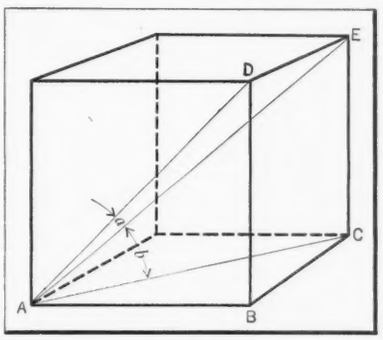


Diagram in which Diagonal Represents Axis of a Pencil Mill for Milling Square Corners

If an attachment having only one angular adjustment is used, it will be necessary to locate the work so that the center line bisecting the corner to be milled will be parallel to the table slots. In this case both longitudinal and transverse feeds must be operated simultaneously to clean up the bottom of the corner.

The solution for obtaining the angle of inclination for the cutter is based on the diagonal of a cube. One corner of the cube, as indicated at A in the illustration, represents the corner of the depression to be milled. Obviously the diagonal AE will coincide with the axis of a cone having its vertex at A and its surface tangent to the surfaces of the three sides of the cube meeting at point A. Now, if this cone represents the pencil mill, angle b will be the angle of inclination of the mill, as well as one-half the included angle of the mill.

Assume that the side of the cube equals 1 inch. Then, in triangle ACE,

$$\text{Tan } b = \frac{1}{\sqrt{2}} = 0.70711$$

Thus the angle of inclination of the pencil mill $b = 35$ degrees 16 minutes, and the included angle of the mill $2b = 70$ degrees 32 minutes.

Failure to Enforce Safety Rules

L. K.—A manufacturing plant required its drop-hammer operators to wear a safety device consisting of a leather strap attached to the hammer and the arm of the operator in such manner as to jerk the hand of the operator out of danger if it was not in the clear when the hammer fell. The rule was not strictly enforced. The foreman protested, but never discharged anyone for not wearing the device. The device was cumbersome and the workmen discarded it most of the time for reasons of comfort. A workman was injured while disobeying the rule to wear the device. Will this prevent the workman from recovering damages, on the ground of a willful disobedience of orders?

Answered by Leslie Childs
Attorney at Law, Indianapolis

Under the facts stated, the failure of the workman to wear the device could hardly be termed willful. In view of the fact that the wearing of the strap caused discomfort, its discarding for that reason alone could hardly be construed as a willful disobedience of orders. Then, too, the failure of the employer to enforce the safety rule must be taken into consideration, and this would probably be held by the Court to amount to a tacit consent to ignore or evade the rule. It is not likely that the violation of the rule under the circumstances will prevent a recovery by the workman. (222 N.W. 251)

* * *

The Revised Simplified Practice Recommendation R17-31, dealing with forged tools, is now available in printed form. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 15 cents. The variety of forged tools has been reduced from 665 to 431.

Annealing High-Speed Steel Tools in the Electric Furnace

By WIRT S. SCOTT, Westinghouse Electric & Mfg. Co., Mansfield, Ohio

TERRIFIC strains and stresses are set up in high-speed and super high-speed steels by forging operations. If these strains are not eliminated before hardening and tempering, additional stresses will be set up in the steel which may cause the tool to break at any time. In fact, sufficient stress may be set up to cause the tool, literally, to explode. Thus, annealing is by far the most important of the heat-treating operations to which high-speed steels are subjected.

In annealing relatively short lengths of forged high-speed steel, it is the general practice to use a muffle furnace, packing mica dust around the steel to provide for slow cooling, as required for proper annealing, and to prevent oxidation by excluding the air. However, trouble is sometimes experienced from the breakage of tools annealed in this manner.

In one case where this method was used, it was found that the charge was not being evenly or uniformly heated. The work consisted of stock forged either into bars or tools from 12 to 24 inches long. Naturally there was some scale left on the surface of these forgings.

The pit type electric furnace designed to overcome the difficulties experienced with this work is shown in the illustrations. It is a vertical cast nickel chromium alloy crucible, 17 1/4 inches in diameter by 35 1/2 inches deep, and has a sand-sealed door. Approximately one-third of the furnace is below the floor level.

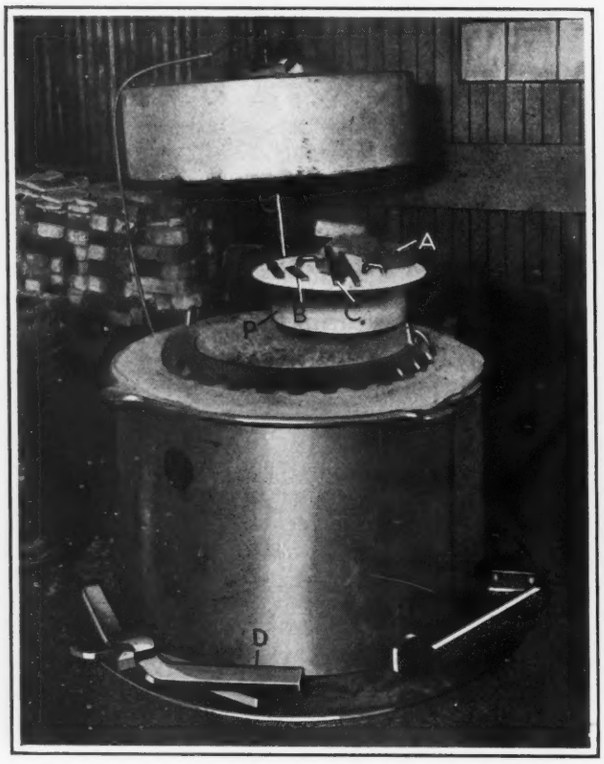


Fig. 1. Electric Pit Type Furnace with Cover and Insulating Plug P Removed Annealed Work Shown at B, C, and D

Fig. 2. Lowering Cover on Furnace Shown in Fig. 1 after Charging the Crucible and Leveling off Sand Seal

This furnace presented an opportunity to experiment with gas as a non-oxidizing agent in place of the mica dust. Charcoal was also tried out, but was found to burn too rapidly. Coke, which was free from sulphur, however, proved to be an entirely successful material. One-quarter of a peck of coke in lumps of the size shown on the insulating plug at *A*, Fig. 1, lasted about a week.

When coke is used, the work appears to have less scale after being removed from the furnace than before the annealing operation. Whatever scale remains is very flaky and can be brushed off with

the hand. The annealing operation requires exactly twenty-four hours, seven hours for heating and seventeen hours for cooling. High-speed steel annealed with this equipment is found by tests to be dead soft and thoroughly annealed. One indication of the effectiveness of this annealing method is the fact that hacksaw blades used to cut up the annealed bars do three times as much cutting before requiring sharpening as they did when the forgings were annealed by the methods formerly used.

Automatic Control of Annealing Furnace

The electric furnace used for this application is equipped with two thermo-couples and a two-point recording and controlling pyrometer. One thermo-couple, of the protected tube type, extends through the top of the furnace. It is of sufficient length to reach down into the center of the charge which is the last point to reach the final temperature. The exact position of this thermo-couple is definitely known from observing the length projecting above the furnace. Thus, "soaking" for two hours after the correct temperature is recorded insures thorough heating throughout the entire charge, so that uniform results are obtained.

The other thermo-couple extends through the side of the furnace, where it is influenced directly by the temperature of the heating elements. The section of one of the temperature control charts, shown in Fig. 3, indicates the functioning of the thermo-couples and the pyrometer. The charge is heat-treated at 1652 degrees F., or 900 degrees C., as indicated on the recording chart. Hence, the instrument is set to keep the charge at that temperature. The limiting temperature on the heating element is fixed by the pyrometer setting at 1796 degrees F. (980 degrees C.). On heating up, the temperature of the heating element reaches 1796 degrees F. before the work reaches 1652 degrees F., where the control cuts off the current.

The charge continues to heat up for a short period of time after the current is off, and when the current comes on again there is only a small difference between the temperature of the charge and the heating element. One more cut-off of the current and the temperature of the charge reaches the required 1652 degrees F. (900 degrees C.). From this time on, the temperature of the charge controls the current, cutting it on and off so accurately that the temperature of the charge does not vary more than 12.6 degrees F. (7 degrees C.), while the maximum temperature of the heating element becomes 1760 degrees F. (960 degrees C.).

Thus, at the operating temperature, the temperature of the heating element is only 140 degrees F. (60 degrees C.) above the temperature of the work. After the charge is held for two hours at 1652 degrees F., the current is cut off. When cooled to 752 degrees F. (400 degrees C.), the charge may be removed from the furnace. About 350 pounds of high-speed and super high-speed steel, valued at from $1.50 to $2.50 per pound, is heat-treated at a time in the electric furnace, as described.

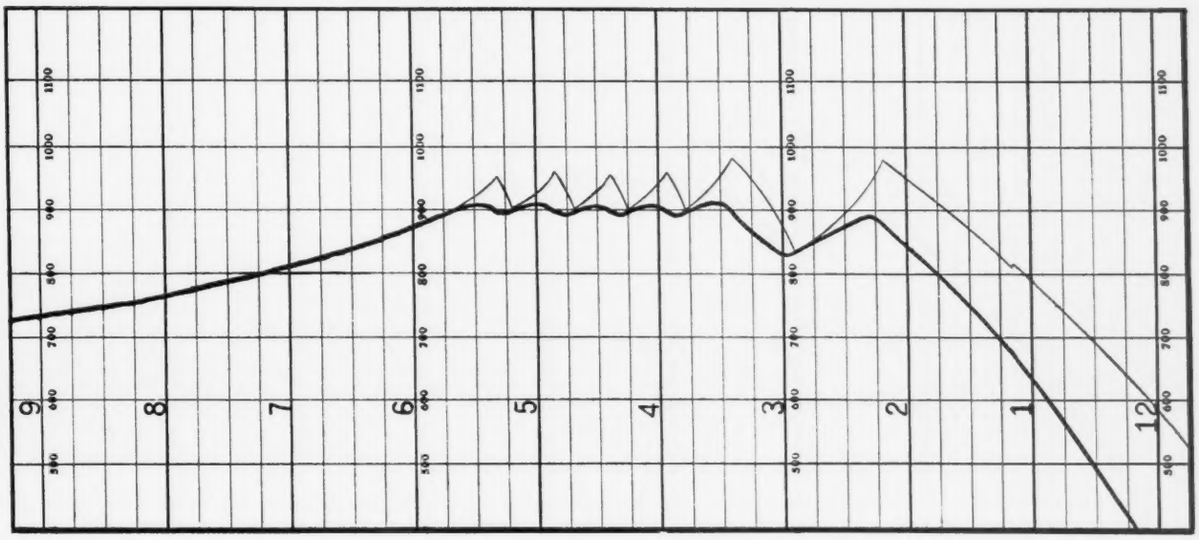


Fig. 3. Temperature Control Chart, with Heavy Line Recording Temperature of Charge, and Light Line Indicating Temperature of Heating Element During Annealing

Tests Show Close Temperature Control and Low Cost of Annealing

Repeated tests on the furnace illustrated showed maximum differences in temperature within the charge of only 20 to 36 degrees F. At the time the temperature chart shown in Fig. 3 was made, 400 pounds of steel was annealed in the furnace, with a power consumption of 135 kilowatt hours, which represents a production of 3 pounds of steel per kilowatt hour consumed. This shows the low cost of annealing, which is practically negligible as compared to the value of the steel.

Machining the Magnesium Alloy Elektron

Physical Properties, Characteristics, Fields of Application, and Methods of Machining Elektron Alloys

ELEKTRON is a lightweight alloy consisting chiefly of magnesium with aluminum, manganese, zinc, and silicon added in variable amounts according to requirements. It is produced by F. G. Farbenindustrie, A.-G., Frankfort-on-Main, Germany. The specific gravity is 1.8, and the tensile strength varies from 6.3 to 25.3 tons per square inch. The compressive strength ranges from 19 to 28.6 tons per square inch, the elongation from 2 to 18 per cent, and the Brinell hardness from 42 to 90. This range in physical properties is obtained by varying the composition of the alloy.

Elektron alloys are characterized by their high capacity for energy absorption in relation to elastic deformation. The melting point is 1200 degrees F. and the heat conductivity is very high. Burning of the alloys is practically impossible, although the metal in the molten state is subject to rapid oxidation.

Elektron is not affected by alkaline solutions, but when exposed to the atmosphere, gradually acquires a coating or layer of gray oxide which tends to prevent further corrosion. Oxide formation may be prevented by applying suitable lacquers or by greasing or oiling the surfaces exposed to damp air and water.

Fields of Application

The Elektron alloys are used extensively in the automobile and aircraft industries, because of their light weight, strength, and durability. They are employed for highly stressed members such as motor pistons, connecting-rods, pulleys, steering mechanism and rudder parts, wings and fuselage, as well as for such parts as chairs, housings, hoods, and tanks.

Other important fields for this alloy are the textile machinery and machine tool industries. In these industries it is used to lighten moving parts, and thus reduce the power required, as well as to reduce the stresses due to centrifugal force, so that speeds of rotary and reciprocating parts may be increased. Greater accuracy is thus obtained by relieving the working tables, beds, and ways, so that the resulting bending movements and stresses, which affect accuracy, are lessened.

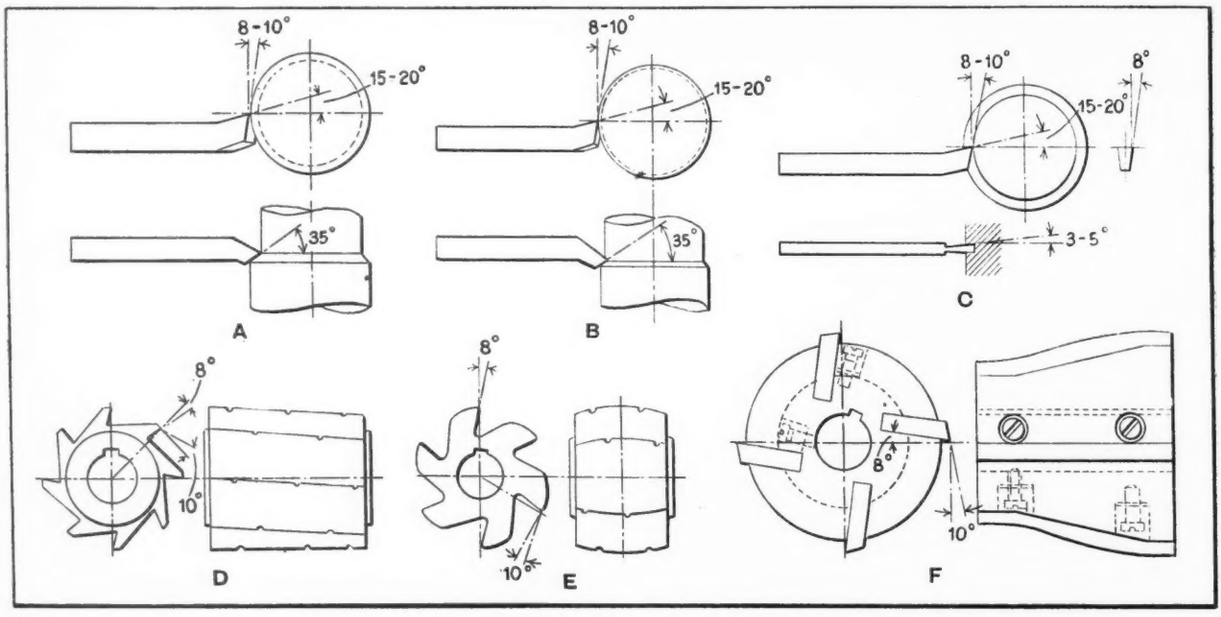


Fig. 1. Examples of Tools Used in Machining Elektron Alloys: (A) Rough-turning Tool; (B) Finish-turning Tool; (C) Grooving Tool; (D) Face Milling Tool with Notched Teeth; (E) Form Cutter with Backed-off Teeth; (F) Inserted-tooth Milling Cutter

Possible Machine Tool Applications

In the machine tool field, Elektron may be employed in the form of cast pieces. For highly stressed parts, it may be used in the form of forgings. High-speed rotating parts, such as reversing pulleys that are subject to rapid changes in direction of rotation; driving and cone pulleys of high-speed internal grinding machines; reciprocating link members of gear-cutting machines; housings of screw-cutting devices and of universal dividing apparatus; rams of spur gear planers or shapers can readily be lightened by the use of Elektron.

An example of its application in this field is an attachment for toolmakers' lathes used for backing-off hubs and similar tools. The driving motor is mounted on a bracket carried by a lever system in the form of a parallelogram. The bracket, together with the motor and the counterweight, imposes an additional load on the lathe bed, and is, therefore, a source of inaccuracies. By making the bracket and lever system of cast Elektron, the counterbalance weight can be reduced and the weight of the whole attachment decreased to a fraction of the weight when cast iron is employed.

On multiple-spindle drilling machines, the spindle housings may be made of Elektron to reduce both the bulk and weight and increase the production and sensitivity, especially when drilling with small-diameter drills.

Another example is a multi-spindle drilling machine of the single-purpose type used for machining typewriter parts. The drilling spindles are arranged on a horizontal indexing carrier disk, the respective groups of spindles being coupled to the main driver, which is mounted at the outer end of a lever system and driven from a central power source. The work is clamped in an indexing fixture on the table. By indexing the fixture and the spindle carrier disk, the respective spindle groups are brought successively into their working positions.

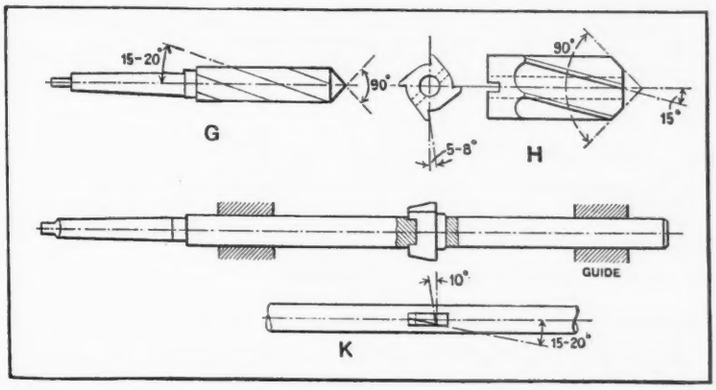


Fig. 2. (G) Drill for Elektron Alloys; (H) Shell Type Drill; (K) Counterbore for Elektron

The horizontal disk, having an outside diameter of 4 feet 7 inches, the swinging lever system that transmits power to the driver, and the vertically adjustable working table are all made of Elektron. This light-weight material makes it possible to actuate the moving parts more quickly and easily; thus the non-productive indexing time is shortened without increasing the strain on the operator. The sliding faces of the table, which come in contact with the cast-iron ways of the machine column, are provided with cast-brass strips to avoid excessive wear.

In using Elektron for machine tool parts, the difference in the coefficients of expansion of Elektron and cast iron should be taken into consideration. Such parts as are in permanent contact with the coolant or cutting compound should be cleaned and oiled regularly.

Portable machine tools may be provided with Elektron housings, bearings, pistons, connecting-rods, etc. Quick-moving cast-iron parts of cigarette manufacturing machinery, which are subject to high stresses, can be replaced by parts made of Elektron with a marked increase in production. This applies especially to the carriers of swinging or oscillating cutters. In one case, substitution of this metal for cast iron resulted in an increase of 60 per cent in the production rate.

Machining Elektron Alloys

In comparing the cost of Elektron alloys with other materials, the ratio of specific gravities should be considered. In some cases, the higher prices of Elektron may be compensated for by the ease with which the alloys are machined. The speeds, feeds, and tools used for aluminum are suitable, but in order to take full advantage of the cutting speeds at which Elektron can be machined, it has been found necessary in some cases to develop machine tools capable of operation at spindle speeds up to 5000 revolutions per minute. Although high cutting speeds are possible, the power required for machining is less than for most other metals.

Forms of Cutting Tools

Figs. 1 and 2 show some of the tool shapes that have proved satisfactory for machining Elektron. Ordinary high-speed steel tools are suitable. In turning operations, the heat developed depends on the rate of feed, the heat being absorbed better with larger feeds than with smaller ones. Flat drills are best adapted for drilling, and in place of counterbores, boring-bar cutters are employed up to diameters of 1 inch.

Boring-bars facilitate chip removal, although in deeper bores, it is desirable to apply compressed air, both for cooling and for removing chips. The high cutting speeds desired are obtained by increasing the diameter of the milling cutter heads. For the first reaming operations, the use of single- or two-edged reamers of the inserted-tooth type is recommended. The length of the cutting edge has considerable influence, both on the absorption of the heat generated and the wear of the edge. For grinding purposes, wheels of 60 to 80 grain and grades K, L, and M give the best results, and do not load or glaze. Finishing and polishing may be done by glass or flint paper, while emery paper, Carborundum, etc., should not be used. Grinding solutions may be composed of either crude kerosene or a 4 per cent aqueous solution of fluoric sodium.

* * *

Many a man has succeeded because he refused to believe that "it can't be done."

Special Tools and Devices for Railway Shops

Recommended by Railway Shop Superintendents and Foremen

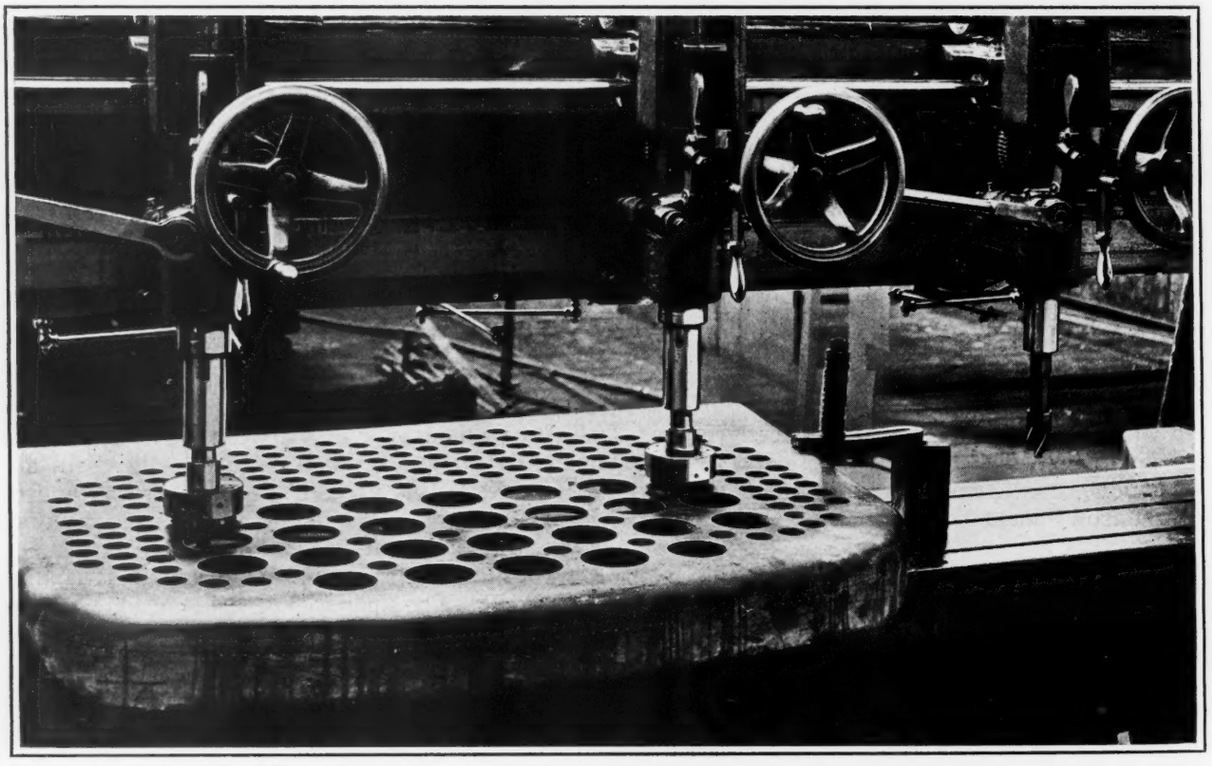
Inserted-Tooth Tool for Cutting Flue-Holes in Tubesheets

Trepanning tools of a solid-tooth design have been used in the past by the Stratford, Ontario, shops of the Canadian National Railways for cutting superheater flue-holes in boiler tubesheets. However, this type of cutter has the drawback that if one or more teeth become broken off, it cannot be repaired and the cutter has to be scrapped. It was on this account that this railway shop recently adopted trepanning tools with inserted teeth or blades, as illustrated in Figs. 2 and 3, for the operation referred to. With this type of tool, if any of the high-speed steel blades become broken, a new blade can be readily substituted.

The operation of cutting the holes in the sheets is performed on a rail-type drilling machine equipped with three drill heads, as shown in Fig. 1. Holes 1/2 inch in diameter are first drilled in the tubesheets to guide pilot *A*, Fig. 3, of the trepanning tool. Two flue-holes are cut at one time by two inserted-tooth trepanning tools held in two of the drill heads. The third drill head in Fig. 1 is shown equipped with a solid type of tool, which is employed for cutting the boiler-tube holes.

Body *B*, Fig. 3, blade-holder *C*, and the combination pilot and shank of the trepanning tool are made of mild steel. Holder *C* is provided with seven slots to receive a similar number of blades. Headless set-screws hold the blades in the slots. The shank of the tool is finished to a standard Morse taper. O. H.

Fig. 1. Cutting Holes Two at a Time in a Boiler Tubesheet to Receive Superheater Flues



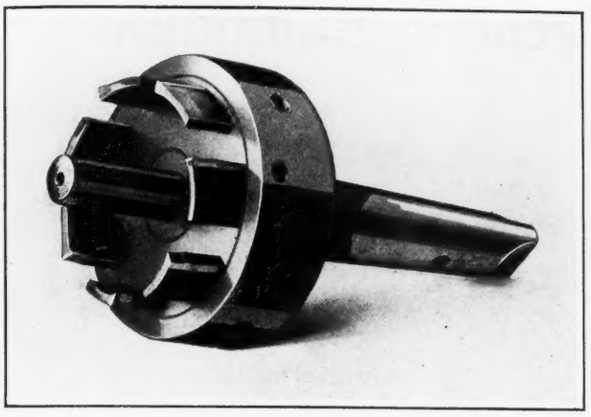


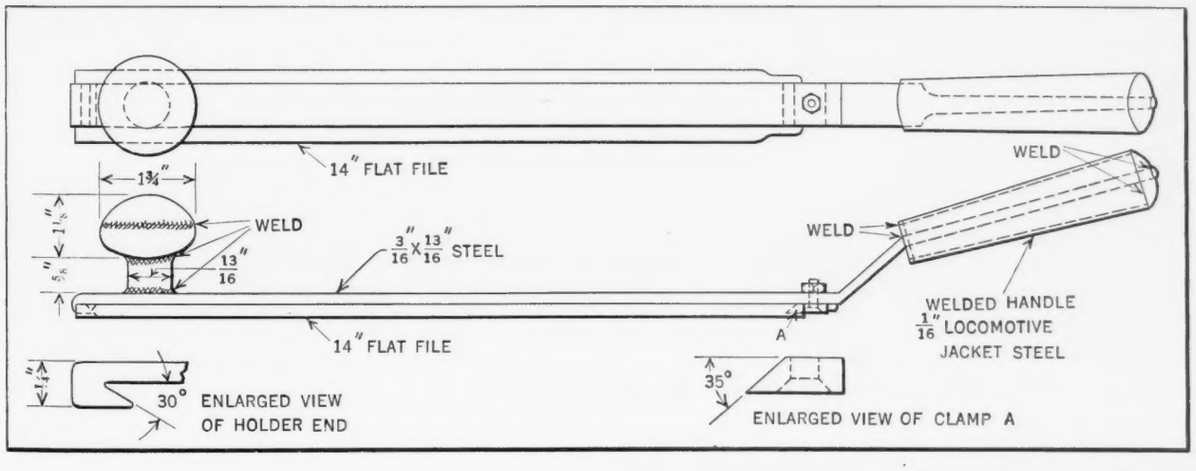
Fig. 2. Inserted-blade Trepanning Tool that can be Easily Repaired when Teeth become Broken

File-Holder that Saves Time in a Locomotive Shop

By E. A. LOTZ, Foreman, Pennsylvania Railroad Shops
Juniata, Pa.

A saving of approximately 20 per cent in the time required for filing and dressing all corners and sharp edges on locomotive side-rods and link-motion parts has resulted from the use of file-holders such as shown in the accompanying illustration. The files equipped with these holders are used to dress the corners to a 1/8-inch radius gage. This removes all cuts, indentations, and marks that experience has shown to be the cause of fractures.

The main advantage of the file-holder is that it provides two comfortable handles, the front ball-handle being set back to clear the end of the file. The complete holder is very light in weight and grips the file securely when the simple clamp *A* is secured in place. Any make of flat file can be easily ground on the ends to permit the holder to be applied. Both of the handles for the holder are made of 1/16-inch locomotive jacket steel, assembled by acetylene welding.



File-holder Employed in Rounding the Corners of Locomotive Parts

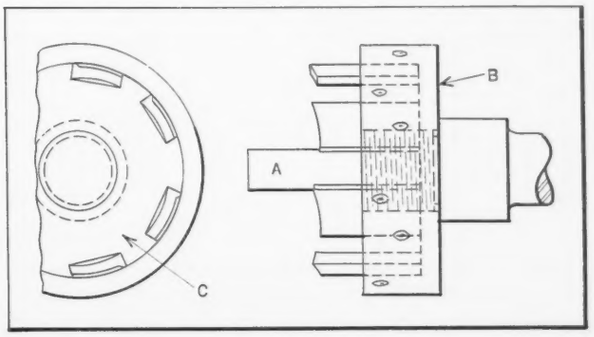
Industrial Machinery Exports in 1931

The complete figures covering the exports of industrial machinery from the United States in 1931 have just been made public by the Industrial Machinery Division of the Department of Commerce. The total exports of American industrial machinery in 1931 were valued at $140,000,000, as compared with $221,000,000 in 1930 and $257,000,000 in 1929.

The metal-working machinery group is the only classification that shows an increase in exports instead of a decrease. The total exports of metal-working machinery in 1931 amounted to $40,030,000, as compared with $39,352,000 in 1930. In fact, the exports in 1931 very nearly reached the record-breaking figure of 1929, when metal-working machinery accounted for $40,803,000. It is also of interest to note that the exports in 1927 were only $25,031,000, and in 1928, $34,125,000.

The strong position of metal-working machinery is largely accounted for by the heavy exports to Soviet Russia, but the United Kingdom, Canada, Germany, and France also took considerable quantities.

Fig. 3. Details of Construction of the Inserted-blade Trepanning Tool Illustrated in Fig. 2



Practical Points on Welding Aluminum

Equipment Required and Methods Used in Joining Sheet-Aluminum Parts by Welding

By ED. SEARLES, Master Mechanic
Naval Aircraft Factory, Philadelphia, Pa.

THE theory of aluminum welding is well outlined in books on the general subject of welding. The fundamental principles are similar to those governing the welding of other metals in thin sheet form, although a different technique or "feel" is required that can only be acquired by practice. It is the object of this article to give only such facts as have been actually proved in daily practice and to present information of practical value to welders who wish to become skilled in the welding of sheet aluminum.

The equipment used for welding sheet aluminum does not differ in any way from that used for welding light-gage sheet steel, except that a small lead burner's torch is employed. This is necessary owing to the high heat conductivity of aluminum. If a large torch is used, the metal will be burned, and the welds will be large and unsightly. The work will also be distorted by too much heat and the inability to concentrate the flame on the weld.

The small lead burner's torch requires a hose of smaller diameter than that used for the regular full-size welding torch. This necessitates either the use of a reducing valve block or an adapter that is fitted directly to the gages. The oxy-acetylene method may be used, although oxy-hydrogen is used on material 1/16 inch thick or lighter, a clean weld being obtained by the latter method.

Type of Weld Favored for Sheet Aluminum

Whenever possible, the flange type weld rather than the butt joint is used for sheet aluminum, the flange being burned down by the torch. In this type of weld, a small flange, approximately 1/8 inch high, is turned at right angles to the sheet. These flanges are clamped together tightly and tack-welded. This type of weld requires the addition of very little filler rod, and has the advantage that the flanges help to keep the parts in shape prior to welding. Clamps for holding the flanges together while they are being tack-welded may be made in the shop out of ordinary 1-inch butt hinges, drawn together by means of a bolt welded to one leaf of the hinge, with the end passing through a clearance hole in the other leaf. Ordinary commercially pure soft aluminum wire, usually 1/16 or 1/8 inch in diameter, is used as a filler rod.

Success Demands the Use of the Proper Flux

It is exceedingly important that a high-grade flux be used, as it is impossible to do high-grade work with an inferior flux. Cost, in this case, is a very poor criterion of quality. Two commercial fluxes that have given satisfactory results in welding aluminum are "Neapolitan" aluminum welding flux, manufactured by the Air Reduction Sales Co., and the aluminum welding flux made by the Aluminum Co. of America.

All aluminum fluxes are hygroscopic and should be purchased only in small sealed glass bottles. Unless the contents are kept airtight, the flux will deteriorate rapidly and poor welds will be the result. The flux is purchased in pulverized form, and a small quantity is mixed with distilled water to the consistency of a very thin paste. It is not advisable to mix more than can be used in one day, and each day the container—usually a porcelain or glass cup—should be washed thoroughly and a fresh supply mixed. The flux is applied to both the work and the filler rod with a small brush similar to an acid swab.

Aluminum should be welded with a neutral flame,

Ed. Searles was born in Philadelphia, Pa., in 1894. He obtained his early engineering training at the Philadelphia Trade School and the Drexel Institute. His first employment was with the Standard Roller Bearing Co. and the Penn Metal Co., both of Philadelphia, where he served as apprentice, journeyman, and supervisor. Later he was employed by the New York Shipbuilding Corporation and the American International Shipbuilding Corporation. With the latter concern he served in the capacity of superintendent of sheet-metal shops and installation of deck and steering engines. In 1922 he was appointed foreman at the Naval Aircraft Factory in Philadelphia. He supervised the fabrication of all metal parts of the dirigible Shenandoah, the first dirigible to be constructed in America. He also supervised the construction of what is believed to be the first all-metal American land plane. At the present time he is master mechanic at the Naval Aircraft Factory in Philadelphia. He is a member of the National Association of Master Mechanics and a member of the board of directors of the "Aircrafters."

as even the slightest excess of oxygen will cause the formation of oxides that will offset the advantages gained by employing the best technique and the highest quality flux. It is far better to use a little too much acetylene than a little too much oxygen. The operator should endeavor to develop as light a touch as possible, and must always be alert for any signs of the metal falling away, due to the application of too much heat. In using a neutral flame, the white inner cone should be kept away from the metal about 1/8 inch and the torch inclined at an angle of about 30 degrees. The so-called forehand or forward method of welding is used in preference to the backhand method. With the forward method, a welder points the torch toward his left and welds from right to left, the flame penetrating the work somewhat in advance of the weld. The torch is usually worked with the acetylene gage indicating a pressure of 15 pounds and the oxygen gage indicating a pressure of 30 pounds.

Preparation of Work for Welding

The flanges on the pieces to be welded must be laid out and turned so that they fit neatly and tightly together; otherwise a ragged weld will result. Work having large unsupported areas of light material will often buckle as the result of heat expansion. This can be prevented by producing expansion beads on each side of the weld line. The beads are usually about 1/8 inch in depth and must be reasonably close to the weld or else they will act as stiffeners and defeat the purpose for which they are intended—namely to provide a surplus of metal to absorb the stresses and strains set up by expansion and contraction of the metal due to the heat. If these beads are not provided, the expansion and contraction will cause buckling throughout the entire work.

After applying the beads, the flange seams are placed together and clamped every two or three inches. The hinge type clamps hold the flange plates together tightly and do not slip off. It might be mentioned here that the edges should be wire-brushed before they are clamped together in order to insure clean joints. When the joints are all clamped, the spaces between the clamps should be looked over and any places where the flanges do not lie close together should be squeezed together with flat-nosed pliers.

After this has been done, the work is ready for tack-welding. The welding rod, which is ordinarily pure aluminum wire, usually 1/8 or 1/16 inch in diameter, is slightly heated with the torch for a distance of about 8 inches from the end. The flux is then put on with a small brush, but it is not applied to the seams at this time. The torch is applied to the seam between clamps, and a very small area of the flange is fused, practically no metal being added with the filler rod unless opening of the flanges makes this necessary.

The main use of the filler rod in making the tack weld is to supply the flux for the joint and assist in fusing the flanges when they become molten, in much the same manner that a weld in cast material is puddled. This is accomplished by touching the edges of the flanges lightly with the filler rod at the moment the metal becomes molten. Tack welds are made about every inch, and the clamps are then removed. The seam is next thoroughly cleaned by means of a wire brush. The brushing should be done vigorously, as clean joints at this stage are essential.

The flux is next applied to the seam, coating it thoroughly. The flux is also applied to the wire and the torch played directly on the seam, being moved back and forth over a space of about 8 or 10 inches until the flux becomes liquid and starts to flow. The seam is then in the proper condition for welding. The remaining procedure is the same as in welding light-gage sheet steel, except that a great deal more care is necessary in order to obtain good fusion. As the flanges are burned down, the molten metal should be constantly agitated with the filler rod to break up the oxide film and thus produce a sound weld.

A great deal of care and practice is necessary to determine the exact moment the metal becomes molten, as there is an extremely short temperature range between the point when it actually becomes molten and the point when it burns and falls away. Determination of the exact moment when the metal becomes plastic is more a matter of instict, developed by practice, than by color indication, and is one of the things it is practically impossible to describe in writing. Aluminum flux has a decided corrosive action if permitted to remain on aluminum, and should be removed either by immersion or scrubbing with a dilute solution of sulphuric acid (5 per cent) followed by rinsing in hot water.

Rubber in Machine Design

New developments in the application of rubber mountings have opened up a broad field for this material in machine construction. While rubber has achieved the distinction of being one of the more important materials used in industry, it is only recently that it has found a thoroughly practical application in machine design. It has been used now and then for special purposes, but as a recognized part of machine assemblies, it may well be classed as a new material. However, great strides have been made during the last few years in making rubber applicable to many purposes in machine design, especially where vibration-absorbing mountings are required. April MACHINERY, in an article "Rubber, a New Material in Machine Design," will show dozens of examples of vibration-absorbing applications.

* * *

"We are pleased to report that the year 1931 was very satisfactory, and we credit this success to our sustained advertising program more than to anything else."—*F. C. Engelhart*, President, Kester Solder Co., Chicago, Ill.

An Unemployment Insurance Plan that Works*

The Leeds & Northrup Co.'s Unemployment Fund, Started Nine Years Ago, Has Proved an Effective Method of Coping with the Present Emergency

THAT the present unemployment situation as it affects the industrial worker can be combated successfully has been proved conclusively by one of our large industrial corporations, the Leeds & Northrup Co. of Philadelphia, Pa. During the slack period of 1921, this corporation was caught, like many others, with large inventories and was forced to reduce its personnel considerably. Contact with some of the discharged employes made apparent the hardships inflicted and the great social harm resulting from unemployment. Determined to be in a position in the future to provide against this evil, this company inaugurated in 1923 an Unemployment Fund.

An initial deposit of $5000 was contributed by the company and an arrangement made whereby 2 per cent of each payroll was added until the total should equal twice the largest payroll of any week in the previous twelve months. It was estimated that such a fund would be sufficient to pay suitable allowances to those laid off or who had their working hours reduced. The fund was placed with a trust company under agreement that it could not be used for any other purpose than that for which it was intended.

The Leeds & Northrup Unemployment Fund was started with an initial amount of $5000 in 1923 and grew to a sum of $82,000 in 1930. This fund has made it possible to maintain a steady income for employes that have been laid off because of business conditions; 75 per cent of their regular wages has been paid to those men having dependents, and 50 per cent to those without dependents. The fund has proved to be ample to meet these demands up to the present time and to leave a very safe margin. Hand in hand with this fund has been developed a plan for stabilizing employment, so that the number who would have to receive unemployment benefits in slack periods would be reduced to a minimum. The results of the plan have proved that it is feasible for an industrial corporation to create an adequate unemployment reserve.

By January, 1930, this fund, together with the accumulated interest, had grown to $82,000. Up to this time few demands had been made upon it. Since then, however, about $42,000 has been paid out, allowances having been paid to 168 discharged employes and to 502 who had their working hours reduced. Thus it will be seen that little more than one-half of the fund has sufficed to meet the demands upon it up to the present time.

The Employes Themselves are Responsible for the Management and Disbursement of the Fund

A body representative of the entire personnel assumes chief responsibility for the management and disbursement of the fund. This body is known as the Council and functions in many other ways in connection with the welfare of the personnel. The control of the fund is vested in a committee of five members of whom three are appointed by the Council and two by the management. Only employes whose income is $2600 or less are eligible to receive benefits. Those having dependents are entitled to 75 per cent of their wages and those without dependents receive 50 per cent of their regular weekly pay.

The benefit is paid regardless of whether a man is discharged, laid off, or works less than the regular forty-four hours a week. Anyone discharged because of negligence or inability does not, of course, receive benefits, but he may contest his dismissal before an appeal board, the members of which are appointed annually by the Council.

The benefit period depends upon the length of service, and ranges from three weeks for three months' service, to twenty-six weeks for five years' service. In general, each year of service adds five weeks' compensation. Should the recipient get another job, the benefit is stopped, but if he loses that job, he may be reinstated, provided he has not had all the payments due him.

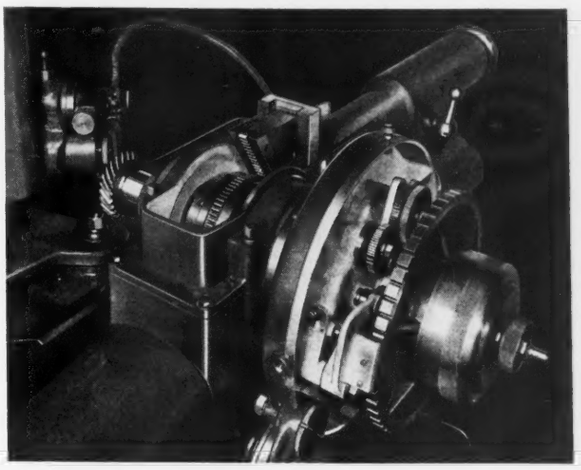
Of those employes who have drawn benefits, 36 per cent who were laid off found new jobs before their benefits ceased. Fifty-five per cent, not so fortunate, drew their entire benefits, while the remainder did not apply for the benefits. To take care of those whose benefit payments have expired, the Council has provided loans or gifts from a separate fund, created by those remaining on full pay. However, only eighteen applications for such loans have been made, and they were for relatively small amounts each week.

Another plan has also been adopted by this company, which operating hand in hand with the benefit fund described, has done much to contribute to the success achieved in handling the unemployment situation. This is a plan for stabilizing employment. During brisk business periods, the working hours are automatically increased, and time and a half is paid for over-time. When the work slackens, the plant returns to the standard week. With this arrangement, the necessity of hiring new employes during a peak period and laying them off later is avoided. Incidentally, the over-time pay presents an opportunity for the employes to share in the company's prosperity during periods of active business.

*Abstract of an article by Morris E. Leeds, president of the Leeds & Northrup Co., published in *Forbes* magazine.

New Shop Equipment

Latest Developments in Machine Tools, Unit Mechanisms, Machine Parts, and Material Handling Appliances



Resharpening Machine for Flat-Face Helical Gear-Shaper Cutters

An involute helicoid grinding machine has been developed by the National Tool Co., Cleveland, Ohio, for resharpening helical gear-shaper cutters of the flat face or flat top type. This machine operates on the describing-generating principle. Its construction is shown in Figs. 1 and 2.

In resharpening cutters of this type, the end face should first be ground on a circular surface grinding machine to obtain a flat smooth surface in a plane perpendicular to the cutter axis. Then the intersecting involute helicoid surfaces should be reground in the machine here described.

For this operation, it is most convenient to use a cylindrical grinding wheel of fairly small diameter. The wheel is mounted with its axis in a plane tangent to the base cylinder of the cutter. The diameter of the cylindrical wheel should be such that the elliptical section through the wheel in the plane of the cutting edge being generated, which is perpendicular to the cutter axis,

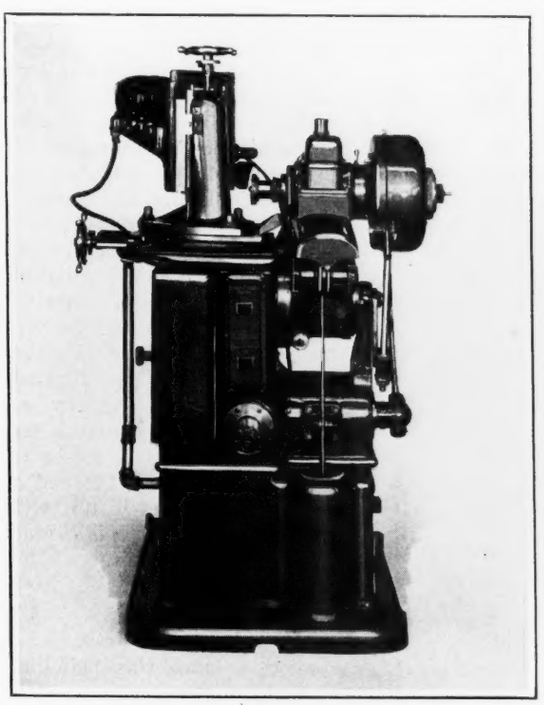


Fig. 1. Grinding Machine Built by the National Tool Co. for Resharpening Flat-face Helical Gear-shaper Cutters

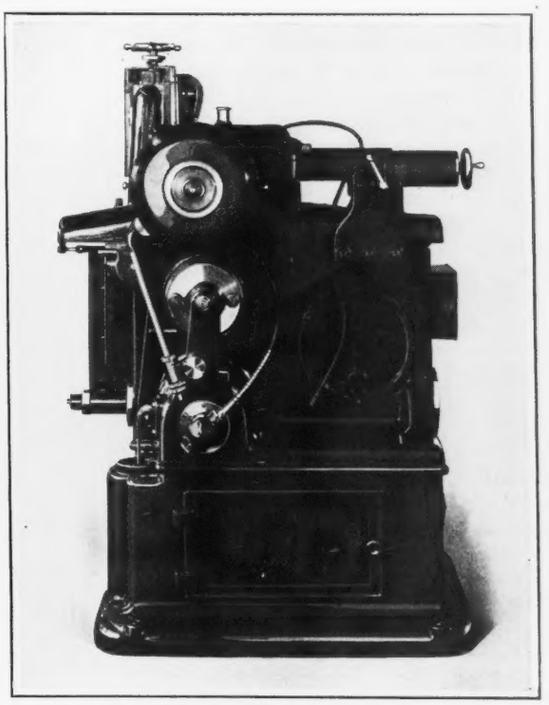


Fig. 2. View of Gear-shaper Cutter Resharpening Machine, which Shows the Drive to the Index-head and Other Construction Details

will have a radius at its vertex not greater than the radius of the involute at approximately the root line of the tooth. When this is the case, the grinding wheel will be tangent to the involute curve of the cutting edge during the entire resharpening operation.

During the resharpening generating action, the cutter rotates about its axis and the grinding wheel has a relative linear movement in a plane at right angles to the cutter axis. In setting up the machine for an operation, the grinding wheel axis is positioned above the cutter axis an amount corresponding to the radius of the base circle. The correct position is determined by means of a scale and vernier.

Next, the grinding wheel head is swiveled to correspond with the helix angle of the cutter, a reading being taken from the graduated base and its vernier. If an under-cut is desired, this angular setting of the wheel may be decreased for the obtuse side and increased for the acute side an amount equal to the undercut. This is true for both right- and left-hand cutters. For right-hand cutters, the angular setting is read from one vernier, and for left-hand cutters, from the opposite vernier.

A motor on the grinding-wheel slide drives the wheel-spindle. There is a switch for reversing the rotation of this motor, since it is desirable always to rotate the grinding wheel against the movement of the cutter. This motor is stopped and started by means of the upper snap switch in the box at the front of the machine, as seen in Fig. 1. The lower switch controls the motor that operates the machine proper.

A different rack wedge (used for reciprocating the work-spindle slide) is required for each base circle diameter. This wedge can be inserted in the machine and removed without the use of tools. The heading illustration shows the rack wedge in its highest position. The index-plate seen in the same illustration is detachable. It must either have the same number of notches as there are teeth in the cutter or else the number of notches must be a multiple of the number of teeth in the cutter. The change-gears necessary for different numbers of cutter teeth are indicated by a chart furnished with each machine.

When the operator starts the motor in the base of the machine, the connecting-rod attached to the index-head reciprocates, and, in turn, oscillates the index-head on its axis. The rack wedge, by meshing with a gear on the work-spindle, then reciprocates the work-spindle slide forward and backward. In the outer position of the slide, while the grinding wheel is out of contact with the work, the cutter indexes automatically a distance of one tooth. This operation cycle is repeated until all the teeth in a cutter have been resharpened.

Experience has shown that about thirty-five indexes per minute constitutes a good working speed for the machine. Thus, if four passes are necessary to resharpen a thirty-five-tooth cutter on each side of the teeth, the actual grinding time will be eight minutes. The average resharpening time is fifteen minutes per cutter, allowing for loading and unloading.

The depth of cut taken by the grinding wheel is controlled by the handwheel on the wheel-spindle slide. There is another adjustment by means of the knurled handwheel at the outer end of the index-head for rotating the work in order to position it with respect to the grinding wheel. The slide as a whole may also be moved forward or backward to bring the front edge of the grinding wheel accurately above the cutter axis. This machine has a weight of approximately 3000 pounds.

Landis Automatic Polishing Machine

Valve tappet stems are polished at rates of from forty to fifty per minute in the machine here illustrated, which was recently designed by the Landis Tool Co., Waynesboro, Pa. About 0.0002 inch of stock is removed. This machine is automatic, the only work of the operator consisting of placing the parts in the work-holding turret.

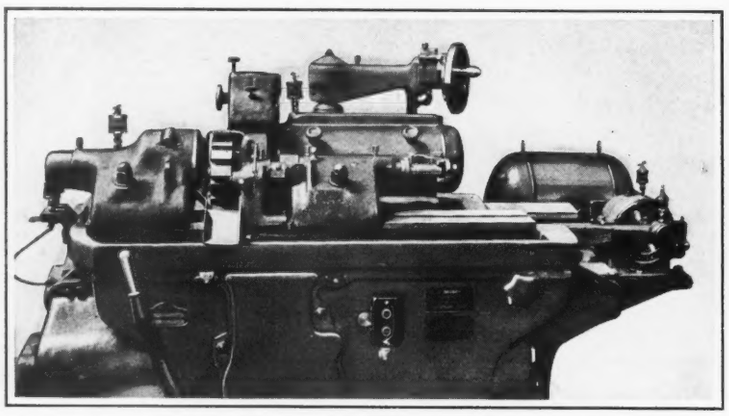


Fig. 1. Landis Polishing Machine Equipped for Handling Valve Tappets

Just as soon as the turret carries a tappet into the polishing position, the wheel carriage starts moving toward the left-hand end of the machine, that is, toward the work. Footstock spring tension is thereby released, causing the footstock center to advance until it comes into solid contact with the end of the work positioned in line with the polishing wheel. This contact seats the head of the tappet in a cupped headstock center. Rotation of the work is then started by friction.

By this time the polishing wheel has started across the tappet stem. As the side of the polishing wheel is about to touch the tappet head, the direction of

the wheel-carriage movement is reversed. As soon as the wheel passes off the tappet, the footstock center withdraws and a spring-loaded plunger in the headstock center pushes the polished part back into its original position in the turret.

The turret next indexes to bring another piece into the polishing position, the finished piece dropping from the turret into a chute which carries it to the front of the machine, where it drops into a suitable receptacle. The work-spindle rotates continuously, the lever at the front of the bed being used to stop its rotation when desired.

Piston-pins, valve-stems, and similar parts could also be polished in this machine. A 7 1/2-horsepower constant-speed motor is recommended for the main drive, and a 1/2-horsepower constant-speed motor for reciprocating the wheel carriage. The polishing wheel is 14 inches in diameter.

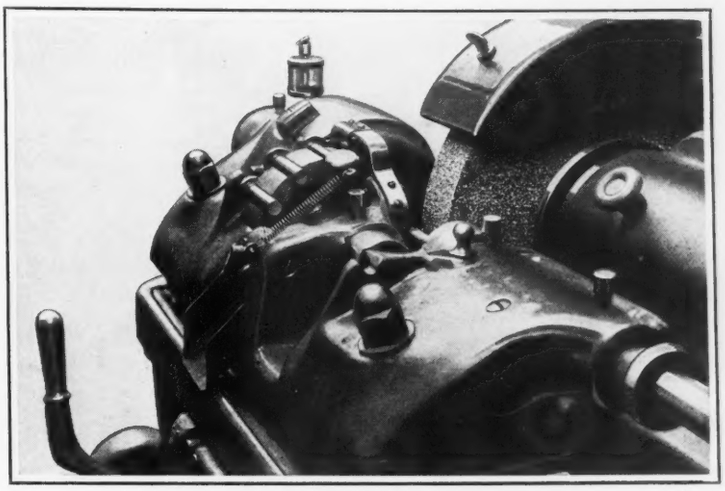


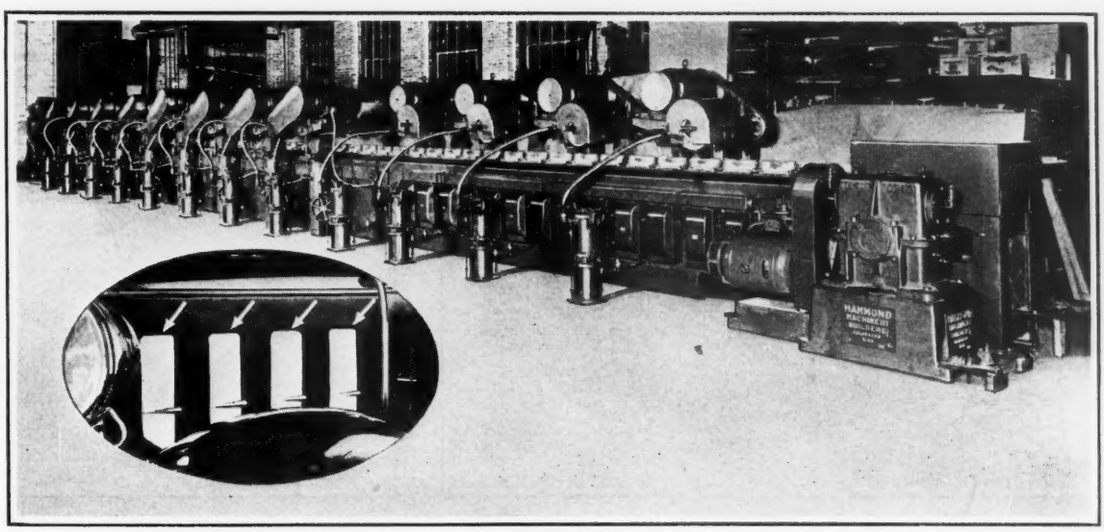
Fig. 2. Close-up View of Polishing Operation on Valve Tappet Stems

Hammond "Strait-Line" Automatic Polisher and Buffer

An automatic machine designed for polishing and buffing the top and inside edge of the hinged ventilator doors used on the hoods of automobiles has recently been produced by the Hammond Machinery Builders, Inc., 1604 Douglas Ave., Kalamazoo, Mich. From the illustration it will be seen that this machine has twelve polishing and buffing heads in line. The doors to be polished are 12 inches long by 4 inches wide. They are finished in one pass through the machine at the rate of 900 per hour.

Other work not requiring a rotating work fixture can also be handled on this machine. A high finish and speedy operation are obtained through the caterpillar type of conveyor unit used. The cast-iron platens that form this conveyor are machined to a high degree of accuracy and are well aligned. Various types of fixtures or adapters can be attached to them for polishing the side or top of parts. The platens, which are chain-driven, are mounted on hardened rollers and run on continuous rails.

The polishing and buffing heads are complete units driven by motors through multiple V-belts. The speed can be varied either by using different sheave diameters or by equipping them with



Hammond Buffing and Polishing Machine with Twelve Heads in a Line

Hammond variable-speed pulleys. These pulleys permit of increasing the speed up to 50 per cent more than the low speed.

The wheel-spindles oscillate individually. The polishing heads are supported by vertical columns which can be raised or lowered, and it is possible to adjust the wheels from a vertical to a horizontal position. Automatic composition feeders at the front of the machine are connected to the wheels by flexible hose. These devices deliver composition paste to the wheels by compressed air through distributing nozzles. The centrifugal force of each wheel carries the composition to a fabric collector pad clamped to one side of the nozzle. This pad applies a definite film of composition to the wheel face, either intermittently or continuously.

Lo-swing Model K Automatic Lathe

There has recently been added to the line of Lo-swing automatic lathes built by the Seneca Falls Machine Co., Seneca Falls, N. Y., a Model K machine, which is intended primarily for machining short stubby work, such as ball-bearing races, gear blanks, and other pieces that can be held either on an arbor or in a chuck. This machine is of unusually heavy construction, weighing approximately 8700 pounds. It is designed for high-speed operation, and the spindle may be run at speeds up to 2000 revolutions per minute. Anti-friction bearings are used throughout, and all shafts and gears that are subject to wear are hardened.

The feed for the tool mechanism is obtained by means of cams. These cams impart a rocking movement to the 6 1/2-inch diameter tool-bars, which extend through the machine and carry tool supports at their outer end. Additional tool movement is provided for by shafts which extend through the tool-bars to operate the tool-slides when desired. Thus, for taking an angular cut, the tool-bar may be rocked into position and held securely, after which the additional feeding mechanism advances the tool-slides at the desired angle and rate of feed. This arrangement is of considerable use in machining bevel gears.

The control mechanism for the rapid traverse, the opening and closing of the chuck, the return of the tool-slides, etc., are hydraulically operated. Pick-off gears are provided for the feed, rapid traverse, and spindle speed. The motor is mounted at the rear of the machine, as is also the coolant pump.

The machine as illustrated is equipped with an automatic device for loading roller-bearing races on the stub arbor on which they are held for machining. After each race has been completed, it is ejected hydraulically from the arbor and separated from the chips. The chips fall into the truck, while the races are conducted down a chute which leads through the square opening seen in Fig. 1 above the front wheel of the truck. A tote box can be placed in front of this opening to receive the finished work. The entire loading device is operated hydraulically. Safety features protect the machine.

This automatic lathe can also be furnished as a hand-operated machine, without the loader, or it can be equipped with other automatic loading arrangements. When arranged for hand-loading, the machine is started by pressing a lever, after which it will go through a complete cycle and then stop. When equipped with an automatic loader, the cycle is continuous. The chip truck may be removed when full and an empty truck immediately rolled into place.

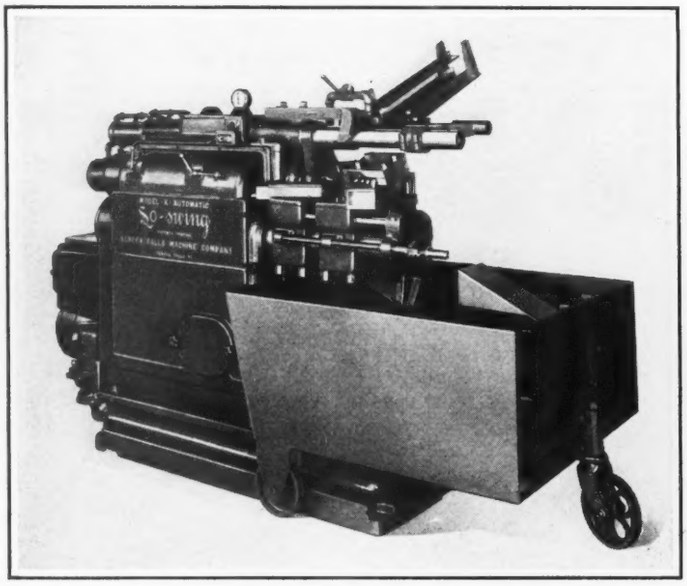


Fig. 1. Lo-swing Model K Automatic Lathe Designed for Machining Short Stubby Work

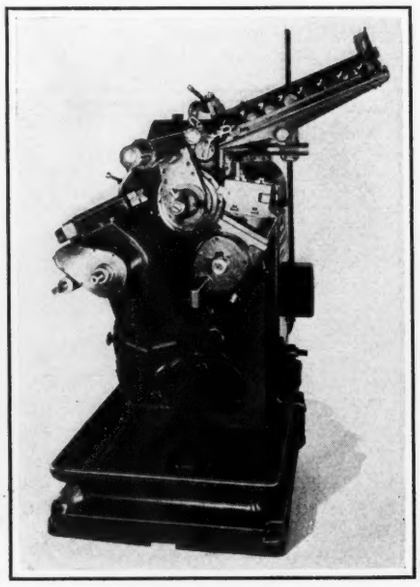
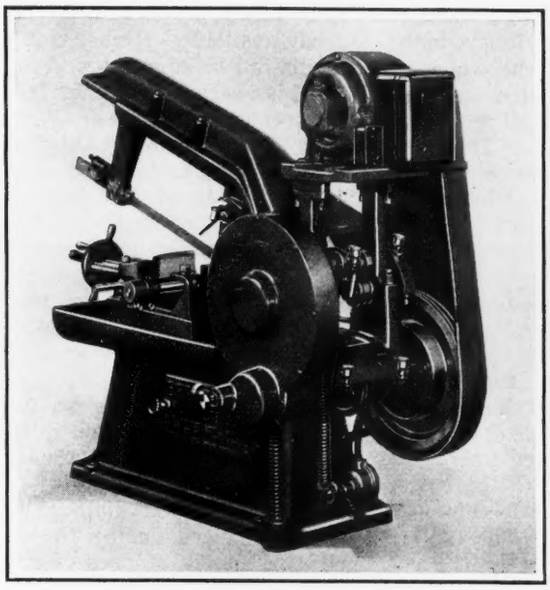
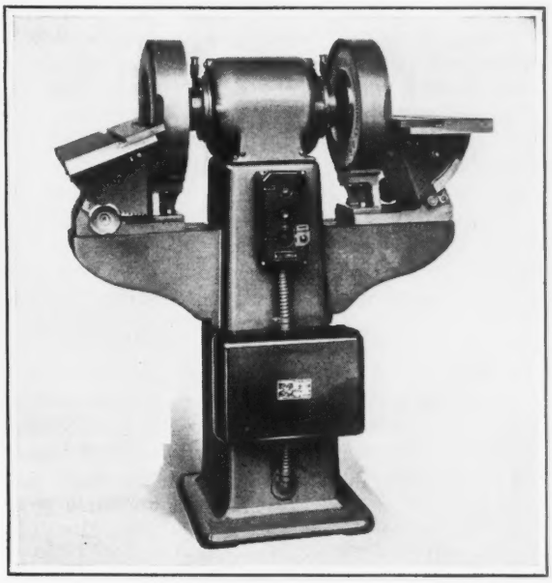


Fig. 2. End View, Showing the Arrangement of the Tool-bars



Peerless Sawing Machine which Operates at 90 and 140 Strokes per Minute



Ransom Grinding Machine Designed Especially for Tungsten-carbide Tools

Peerless High-Speed Metal Sawing Machine

The latest addition to the line of high-speed metal sawing machines built by the Peerless Machine Co., 1613 Racine St., Racine, Wis., is shown in the accompanying illustration. This machine has a capacity of 10 by 10 inches. Two operating speeds are regularly available, one of 90 strokes per minute for tool steels, and another of 140 strokes per minute for machine steel.

Standard equipment includes a motor stand which is built integral with the machine. The arrangement is such that the machine can be driven either from a lineshaft through a belt or by a motor. V-belts are used with a motor drive. Either a full-swivel vise or a plain straight cut-off fixture is provided.

Changes in the feeding pressure are made through a graduated scale and a dial which indicates the amount of pressure, in pounds, applied to the saw blade. A clutch is installed within the drive pulley. When the cutting operation is concluded, the clutch is automatically released and the saw frame then is raised from the work and stops. The saw blade is lifted automatically and positively on the non-cutting stroke, so as to guard against any drag of the blade on the work.

Cutting compound is delivered to the saw blade by a pump located on the outside of the machine at the rear, where it is easily accessible and is protected from chips.

Ransom Grinder for Tungsten-Carbide Tools

A machine designed especially for grinding lathe and planer tools tipped with tungsten carbide has been placed on the market by the Ransom Grinding Machine Co.; Oshkosh, Wis. The grinding is done by means of cup-wheels. Large tables provide ample support for the tool shank in any position.

The tables can be tilted 20 degrees, and they are graduated to facilitate accurate settings. The tilting is accomplished through a gear and pinion, the center of rotation being the edge of the table that is next to the wheel. With this construction, the distance between the table and the wheel is not changed by tilting, and consequently, it is impossible to grind the table edge. The sliding parts under the table have been made dustproof, and are thus protected from emery and tungsten carbide. Both tables, with their guards, are adjustable to compensate for wear.

The motor is reversible by means of a push-button control. This feature, together with the fact that the tables extend past the wheels on both sides, enables the operator to grind clearance on tools in any direction. Also, right- and left-hand tools can be ground equally well. The time required to reverse the arbor from full speed in one direction to full speed in the opposite direction is about four seconds. A roughing wheel is provided on one end of the arbor, and a finishing wheel on the other end.

Noel Polyphase Capacitor Motor

A polyphase induction motor with a capacitor (condenser) so applied that the condenser reactive current flows through the windings of the motor and thereby produces a high power factor within the motor has been brought out by the Ideal Electric

& Mfg. Co., Mansfield, Ohio. The advantages claimed for this arrangement include improved starting and running characteristics. The motor is said to operate with a power factor of practically 100 per cent at all loads.

The capacitor is of the oil-filled, oil-impregnated, hermetically sealed type. It has individually fused sections which are assembled in a steel case for mounting on the wall or in other convenient locations. This motor is similar in appearance to that illustrated in December, 1930, MACHINERY, page 314.

Cincinnati Vertical Miller with Complete "Dual Control"

A new No. 1 vertical milling machine in which all the movements can be completely controlled at both the front and the rear operating positions has been brought out by the Cincinnati Milling Machine Co., Cincinnati, Ohio. There are independent directional control levers at both the front and rear for the power feeds to the table, saddle, and knee. The saddle and knee levers have interlocks that prevent the engagement of both feeds at the same time. Both of these levers are also used for reversing.

There is a power rapid traverse for each of the movements mentioned, with the spindle either stopped or running. The semi-automatic cycle of the table enables the operator to traverse the work rapidly to the cutter, at which point the feed is automatically tripped. The table is stopped at the end of the cut. Rear hand-adjusting cranks with automatic disengaging means provide for quick cross and vertical adjustments with the work and cutters in full view.

Speed and feed changes are made by power from either the front or rear. Sixteen standard spindle speeds, ranging from 20 to 500 revolutions per minute, and table feeds ranging from 1/2 to 20 inches per minute are regularly available. Higher spindle speeds can be supplied, and low- and high-series ranges of feeds are optional.

To change speeds at the front of the machine, the lever at the left-hand side of the saddle is shifted to the left, with the starting lever in the stopped position until the desired speed appears opposite the arrow on the upper colored dial. Engagement of the starting lever then gives the selected speed.

When the feed is to be changed, the same lever is shifted in the opposite direction until the desired feed appears opposite the arrow on the lower dial. Feeds can be changed during the cut with the spindle stopped or running. To change speeds at the rear of the machine, the lever at the back of the box that carries the speed and feed dials is manipulated.

The spindle head is adjustable when the screws are loosened. It is clamped to the frame by means of the lever on the left-hand side. The entire spindle drive from the pulley to the cut-

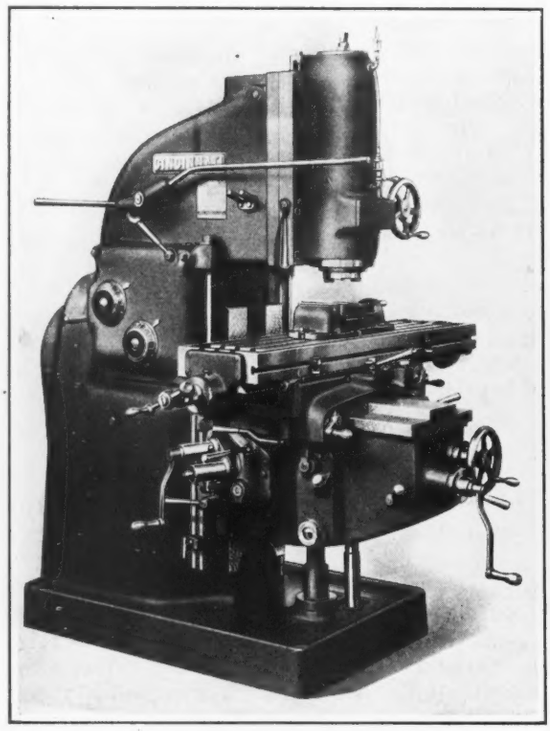


Fig. 1. Cincinnati Vertical Miller which is under Complete Control at Both the Front and Rear

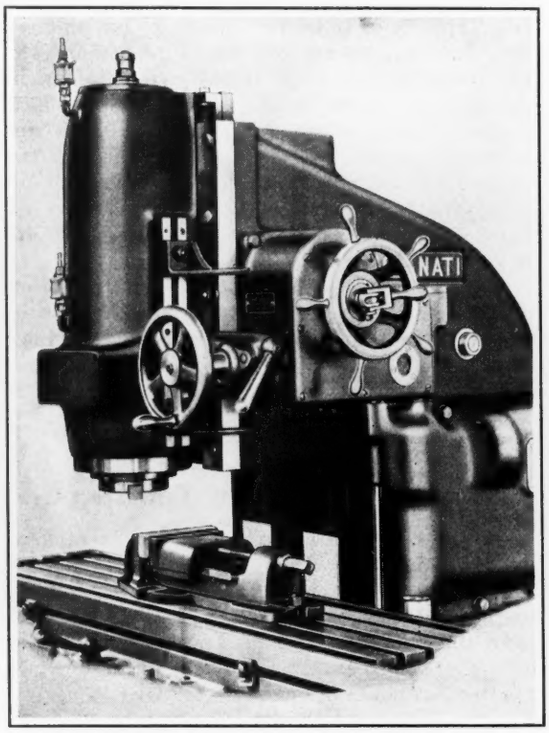


Fig. 2. Either a Hand or Power Feed and a Power Rapid Traverse can be Provided for the Head

ter is equipped with anti-friction bearings. A hand or power feed can be supplied for the vertical head. The power feed and power rapid traverse are obtained through a compact feed mechanism which is substituted for the hand feed-box on the right-hand side of the head, as illustrated in Fig. 2. Sixteen feed changes are available for the head. The power feed can be engaged in either direction by a single lever, and the power rapid traverse is obtained by engaging the same lever and then shifting the power traverse lever for the table, saddle, and knee.

The column mechanism, including the spindle drive and the feed- and speed-shifting mechanism, is automatically lubricated. Automatic lubrication is also provided for the knee, while an "oil-shot" pressure system is used for the saddle and table ways.

The machine has a longitudinal range of 22 inches, a crosswise range of 12 inches, and a vertical range of 15 inches with 6 inches of head travel. The weight of a belt-driven machine is 6050 pounds, and with a chain motor drive, 6150 pounds. A motor of from 3 to 5 horsepower is recommended by the manufacturer.

Henry & Wright All-Steel Double-Crank Press

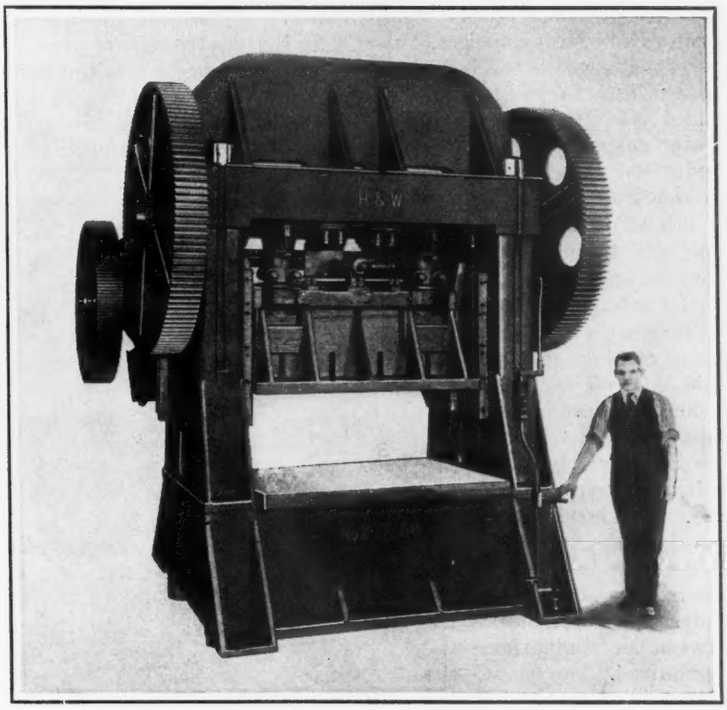
The 350-ton double-crank, straight-sided press illustrated is representative of a new line of all-steel presses of welded construction built by the Henry & Wright Mfg. Co., Hartford, Conn. The bed, uprights, crown, slide, and twin gears are made of welded steel. All the welded parts are annealed and normalized before machining in order to release any stresses set up in the rolling or welding operations. This eliminates the possibility of distortion taking place after the machine is in operation.

The machine is direct-connected to a 20-horsepower ball-bearing motor mounted on the left-hand rear bracket. In addition, there is a 5-horsepower motor for adjusting the slide, mounted on the slide. The construction employed eliminates the need of universal joints between the motor and the gear-box. Power is transmitted to the machine proper through an electrically operated multiple-plate friction clutch.

Four methods of operation are available by means of the control provided. The master control box is located on the right-hand upright. It contains an emergency stop-button for stopping the press instantly at any point in the stroke. A second button is used for jogging or "inching" the slide when setting dies. There is also a third button which can be turned to two positions; one position provides for single-stroke operation, in which case the press stops automatically at the top of each stroke, and the other position allows the press to operate continuously.

Ordinarily push-buttons are mounted on the slide to start the machine after the control button has been turned to either the single-stroke or continuous-operation position. On the press shown, however, a foot-treadle operates a push-button located at the front of the machine, for this purpose. As one or two helpers are required at the rear of the press for removing the finished work, there are four push-buttons on the rear side of the knock-out bar, which must be depressed before the clutch can be engaged. This arrangement insures complete safety of the operators. In the event that only one helper is required at the rear, two of the push-buttons may be locked in the circuit.

A patented internal expanding brake of new design operates in conjunction with the clutch. This brake is so arranged that the press will be stopped instantly in case the electric current fails. Some of the major specifications of the press illustrated are as follows: Distance between uprights, 68 inches; maximum stroke, 8 inches; shut height, bed to slide, 18 inches; area of bolster, 47 by 66 inches; opening in bed, 34 by 50 inches; number of strokes per minute, 17; and net weight of machine, approximately 49,000 pounds.



Henry & Wright Double-crank Press of Welded Steel Construction

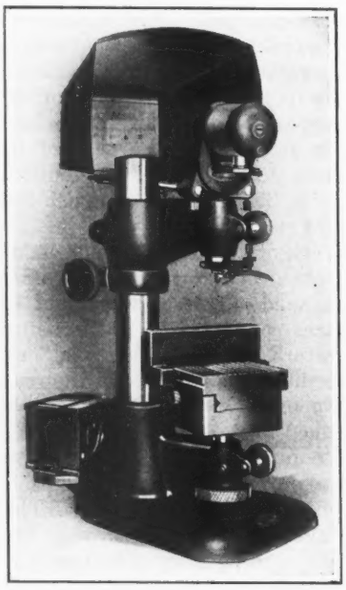


Fig. 1. An "Acro-Lite" Unit Applied to a Comparator

"Acro-Lite" Unit

A mechanical projection instrument which shows a large illuminated image of a scale and pointer on a screen has been produced by the Standard Gage Co., Inc., Poughkeepsie, N. Y., for application to various types of comparators and gaging devices. This instrument, which has been designated the "Acro-Lite," is intended for the inspection of master gages, tools, and accurate production jobs. In some cases, the hood or screen can be placed on a separate table and the unit itself mounted on a fixture for special set-ups.

Three scale images giving readings to 0.0001 inch, 0.00005 inch, and 0.00001 inch can be used, the graduations in each case being widely spaced to insure accurate readings. The hood can be moved back and forth upon the rods on which it is mounted to increase or decrease the distance between the graduations, as required. The changing of scales to suit different work can be effected in a moment's time. This unit is fitted with a diamond gaging point which may be either flat or spherical.

Improved Electric "Hot Spot" Welders

The Acme Electric Welder Co., 5621-A Pacific Blvd., Huntington Park, Los Angeles, Calif., has developed a complete new line of "Hot Spot" hand- and foot-operated spot welders in which a number of improvements over previous models are incorporated. In the new machines, the transformer coils are so wound that, regardless of the welder capacity, thin gages of stock can be welded as satisfactorily as the heavier gages. The transformer coils are impregnated and baked with an insulating compound that, it is claimed, insures practically lifetime service against burn-outs or short circuits. New brake-shoe type horn-holding clamping blocks give a better electrical contact surface.

The positive-locking type of heat regulator cannot be jarred from its setting. Reversible hard-drawn copper horns, 2 inches in diameter, are provided. One end of the horns is machined so that the electrodes are inserted at right angles, while the opposite end is machined to a 22 1/2-degree angle. This makes welding easy in corners and in other inaccessible places.

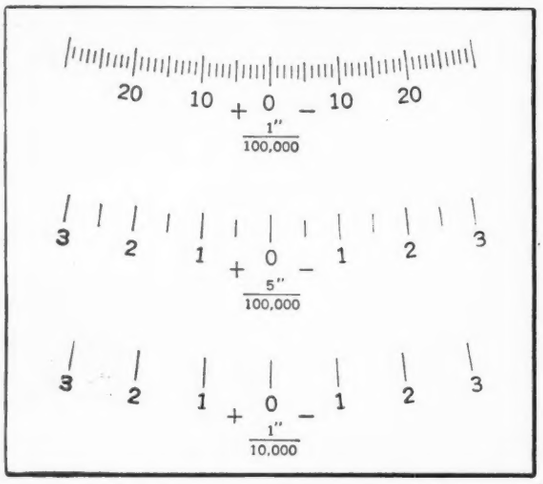
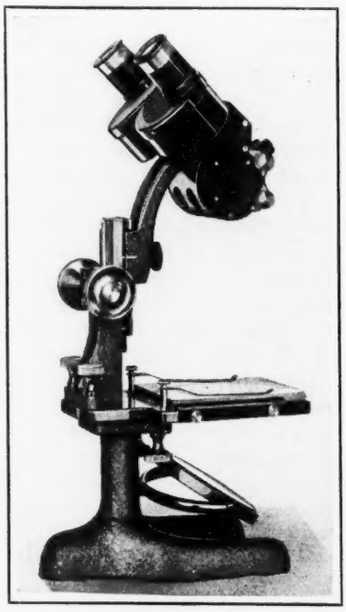


Fig. 2. The Three Scale Images at One-half their Actual Size on Screen



Microscope for Examining Cutting Edges and Metal Surfaces

Bausch & Lomb Microscope for Examining Metal Parts

The Bausch & Lomb Optical Co., 619 St. Paul St., Rochester, N. Y., has brought out a wide-field microscope that is especially adapted for examining cutting tools and machine parts for wear, studying metal surfaces for marks or blow-holes, and making routine microscopic inspections.

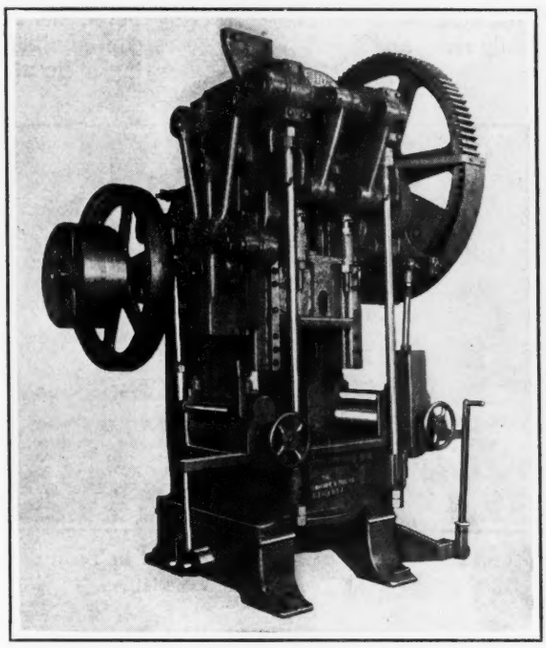
The microscope is mounted on a laboratory stand with a sub-stage mirror that greatly broadens the range of its application. However, it can be removed from the stand when it is necessary to examine large objects. The stage is made of glass; thus either opaque or transparent specimens can be observed. The binocular eye-pieces are inclined to facilitate their use. Five pairs of objectives are interchangeable in the revolvable drum nosepiece to provide true stereoscopic vision. The range of magnification is from 0.7 to 87 diameters.

Toledo Double-Roll Feed for Power Presses

Automatic feeds designed to reduce work-handling to a minimum in producing sheet-metal parts in power presses have been built in various types by the Toledo Machine & Tool Co., Toledo, Ohio. The illustration shows one of these feeds as applied to a double-action toggle drawing and deep-stamping press. The machine is standard, except for the fact that the frame is cut back and heavily reinforced to accommodate the feed mechanism and permit feeding the stock from right to left. The tie-rods shown give additional rigidity.

The stock is fed to the press by rolls on the right-hand side. Motion is imparted to these rolls by a reciprocating rack operated by a crankshaft through a slotted crank and gearing. An adjustment provides for changing the length of feed. The discharge rolls at the left-hand side of the machine are operated by a cross-rack. These rolls are corrugated so as to impart a greater pull on the stock. An adjustable cam-actuated knock-out in the bed lifts the drawn piece out of the die, so that it can be removed quickly. By taking out a plate, the work can be pushed through the press bed.

The feed-rolls are 18 inches wide, the upper rolls being 4 inches in diameter, and the lower rolls 8 inches. Shells up to 7 1/2 inches deep can be drawn in the machine illustrated and lifted out of the dies. The weight of the press and feed is about 40,000 pounds.



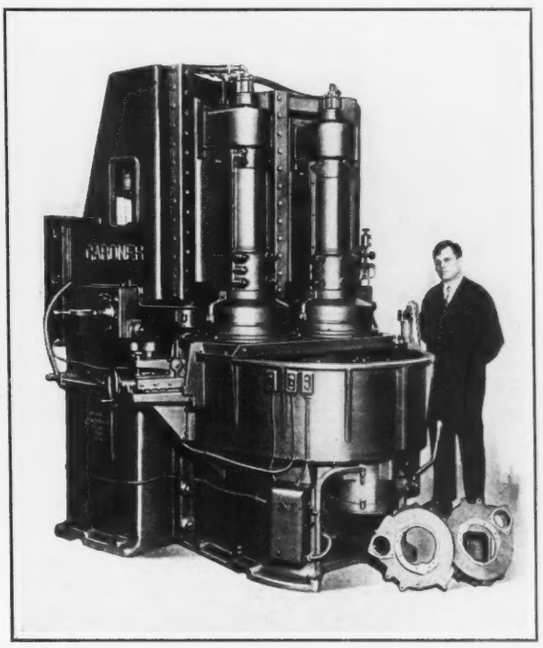
Toledo Toggle Drawing Press Equipped with Automatic Roll Feed

Gardner Duplex Vertical Surface Grinder

A duplex vertical surface grinder in which one side of the work is rough- and finish-ground at a single pass between two abrasive members is built by the Gardner Machine Co., Beloit, Wis. The first abrasive member is a roughing wheel which removes the major portion of the stock, while the second wheel produces the finished surface and corrects any inaccuracies in the first grinding member.

Two automatic air-operated calipers control the accuracy of the grinding. These calipers are mounted on the side of the base. When the ground surface of the work passes from the first or roughing wheel, it comes in contact with the first caliper. If insufficient stock has been removed, the caliper will automatically lower the first abrasive member. As the ground surface passes from the second or finishing wheel, it comes in contact with the second caliper, which will likewise lower the finishing abrasive member a predetermined amount if necessary. The main advantage of the machine is that it permits the roughing and finishing of a flat surface at one setting of the work.

By employing a revolving table with a stationary shaft in the center, it is possible to use a subtable or fixture body in which all of the fixture-operating mechanism is enclosed in an oil-tight and water-tight compartment. The fixture body can be conveniently removed from the table, thus allowing the machine to be employed for other work without disturbing or altering the main table itself.



Gardner Vertical Surface Grinder with Roughing and Finishing Wheels

The two vertical spindles to which the abrasive members are attached are mounted on individual columns. These columns can be adjusted from a right angle into a slightly tilted position, thereby obtaining two cuts with the same wheel at one pass of the work. The tilting of the roughing wheel produces a slightly concave surface on the work, but the concavity is practically eliminated when the work passes under the finishing wheel. This procedure is usually followed on very light or thin work so as to prevent heat distortion, caused by the removal of too much stock in one cut. It also reduces wear of the abrasive wheel.

Each column is self-contained, and is equipped with both automatic and manual means of raising and lowering the spindle to compensate for wheel wear and to finish the work within the specified tolerance. Inside each column there is a bracket on which the spindle driving motor is mounted. These brackets are adjustable for maintaining the proper belt tension. The V-belts can be removed without disturbing anything but the guards.

On each side of the base, directly beneath the corresponding spindle, there is a dresser for sharpening or cutting down the abrasive member. When automatic diamond dressing is necessary, the dresser is mounted on the fixture body and is controlled by a mechanism enclosed in this body. The automatic dresser can be set to true up the wheel at predetermined intervals.

This machine is available in several sizes with wheels from 16 to 20 inches in diameter and with tables either 42 or 72 inches in diameter.

Zeiss Gear-Testing Machine

Spur, bevel, helical, and worm gears may be tested for circular pitch, eccentricity, uniformity of tooth spaces, and uniformity of tooth thickness in a Zeiss gear-testing machine now being placed on the American market by the George Scherr Co., Inc., 128 Lafayette St., New York City. The instrument gives measurements to 0.0001 inch, is easily read, and is rapidly operated.

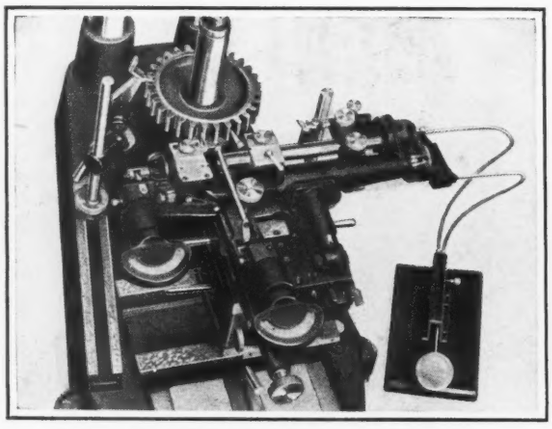


Fig. 1. Checking the Uniformity of Gear-tooth Thickness in a Zeiss Gear-testing Machine

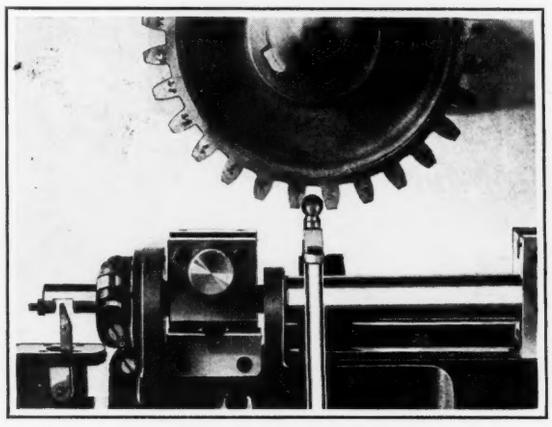


Fig. 2. A Ball-tipped Plunger is Used in Testing the Gear Teeth for Eccentricity

The gear to be inspected is placed vertically between centers, as illustrated in Fig. 1, and can be revolved to bring successive teeth into position for testing. The measuring slide is carried on a compound rest, so that it can be roughly adjusted in two directions at right angles to each other. The slide, on the side toward the gear, is fitted with blades or ball-pointed pins for performing the inspections. Fig. 1 shows the machine fitted with blades for testing the uniformity of tooth thickness, while Fig. 2 shows a ball-tipped plunger being used for determining the eccentricity of the gear teeth.

On the measuring slide are two indicators for peripheral and radial measurements. The measuring slide as a whole is movable to and from the work through the action of a spring that is controlled by an air brake. The gear being inspected is maintained in the proper position by a ball-pointed pin in an adjustable spring finger which is held on a small column. This finger engages a tooth space.

For inspecting bevel, helical, and worm gears, an auxiliary segment bed carrying a circular slide having diametrically opposed centers is placed between the main centers. The gear to be tested is held between the centers in the circular slide. The slide is set at the proper angle for bringing each tooth vertically in line with the front of the measuring slide.

Mertact Mercury Electric Switches

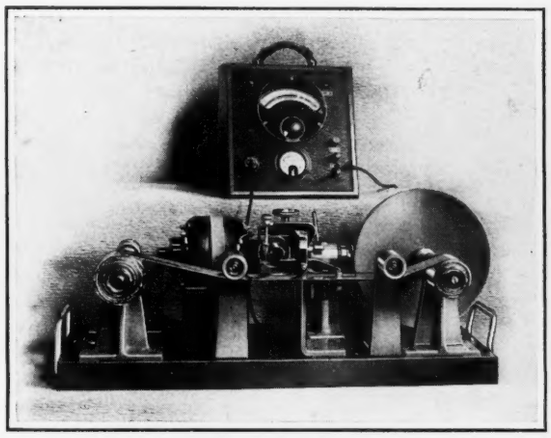
Mercury electric switches in capacities from 1 to 100 amperes have been brought out by the Industrial Division of the CeCo Mfg. Co., Inc., 1200 Eddy St., Providence, R. I. These switches have a wide field of application, being suitable for use with heating devices, automatic tempera-

ture control equipment, and equipment that requires frequent making and breaking of current.

Sizable currents can be broken by a very small mechanical force, often eliminating the necessity of intermediate relays. Another advantage is the enclosed arc feature which permits using the switches where combustible gases or materials are likely to accumulate.

"Electrolimit" Gage for Continuous Inspection of Strips, Sheets, or Wire

The Pratt & Whitney Co., Hartford, Conn., has designed an "Electrolimit" gage for use in rolling strip and sheet stock, wire, foil, etc. This gage shows the size of material being produced at all times, so that uniformity of the work can be maintained without shutting down the mill to inspect the material. The illustration shows a working model of a foil mill with the "Electrolimit" gage in the center between the idler pulleys. The motor moves the foil from left to right through the gage in the same way that the foil would come from the mill.

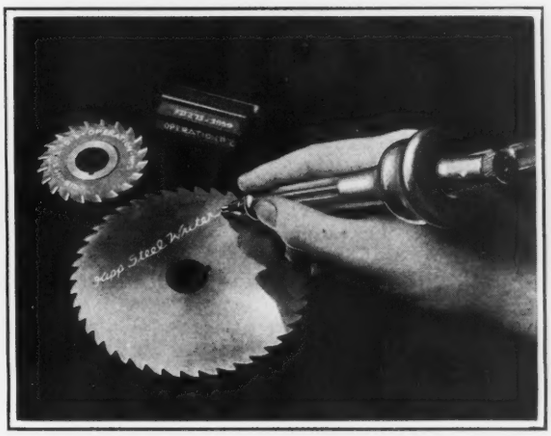


Model Showing "Electrolimit" Gage being Used for Inspecting Foil

The material passes between a gaging anvil and a gaging contact pointer. The latter constitutes one end of a lever that is hinged in the center and is kept in contact with the material by spring pressure. The other end of the lever contacts with the armature lever of the gage head. Thus any change in the thickness of the material is transmitted mechanically to the gage and is then magnified through the electric circuit and shown on the dials of the indicating unit. A photo-electric recorder can be provided instead of the conventional indicating unit when it is desirable to obtain a permanent record of fluctuations in the size of the material. This recorder also has an indicating scale for obtaining readings at any instant.

Kipp "Steel Writer" for Air Grinders

A device known as a "Steel Writer," which will write on hardened steel, glass, lead-coated stock, painted surfaces, etc., when used in the Model AG and BB air grinders manufactured by the Madison-Kipp Corporation, 203 Waubesa St., Madison, Wis., has been placed on the market by the same concern. These grinders rotate the tool at a speed of 40,000 revolutions per minute and more, which is fast enough for cutting steel and other materials as rapidly as the hand can work the tool. The device is particularly suitable for use in tool-cribs, tool-rooms, laboratories, and stock-rooms where a variety of work is to be marked.



Using the Kipp "Steel Writer" for Marking Hardened Steel

Milburn Welding Torch

A Type HMS welding torch intended for all types of welding is being placed on the market by the Alexander Milburn Co., 1416-1428 W. Baltimore St., Baltimore, Md. Swaged copper welding tips are usually furnished, but they may be removed from the torch handle and replaced by extensions of various lengths.

These extensions are light, unbreakable, nickel-silver tubes which utilize the standard Types FX and UB welding tips. The extensions are also interchangeable with the Airco Davis-Bournonville welding torch Style 8800, etc. The torch handle, swaged tips, and extensions provide a convenient equipment for both light and heavy welding.

GE Heavy-Duty Push-Button Stations

A line of unit-type push-button stations (Type CR-2940) intended for general industrial applications has been placed on the market by the General Electric Co., Schenectady, N. Y. This line is divided into three general classes—stations that make momentary contact; stations that maintain the contact; and stations that are a combination of both.

With the momentary contact type, the circuit is completed or interrupted only as long as the

operator's finger depresses the button. This is required when the station is used with a controller that must provide undervoltage protection. A maintaining contact holds the circuit open or closed, as in an ordinary knife switch. Any combination not exceeding five of these units is available in wall mountings.

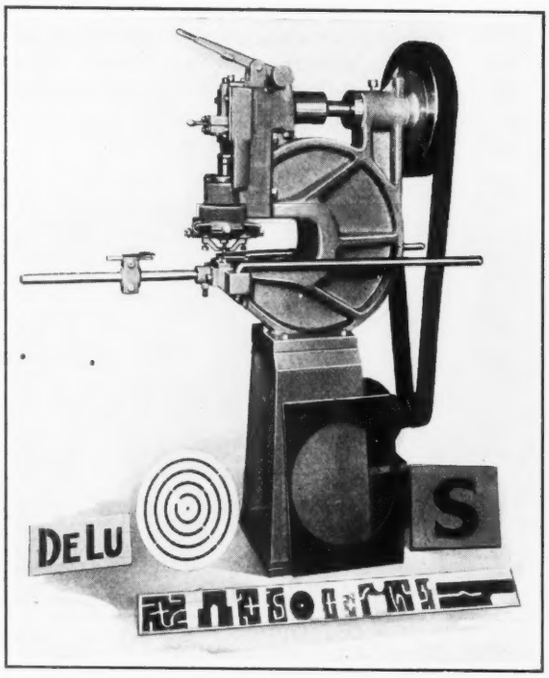
Gray Turret-Head Metal Cutter

A new model of the Gray turret-head metal cutter or nibbling machine is being placed on the market by the Gray Machine Co., Box 596, Philadelphia, Pa. The turret head of this machine allows the operator to cut shapes in sheets or plates to any design without turning the stock through the machine gap or throat. This construction permits the use of a machine with a smaller throat and reduces the required floor space. Shapes can be cut in sheets too large to swing in the throat, and sheets can be handled that are twice as wide as the throat depth, and of any length.

When small pieces are being cut, the turret can be locked in eight different positions. Double adjustable micrometer strippers make it possible, when duplicating parts by means of a master templet, to adjust one stripper on top of the templet and the other stripper on the stock, which is on a lower plane. This prevents the stock and templet from being picked up more on one side than on the other, thus insuring even stripping and preventing chatter and breakage of the cutters.

A gag mechanism instantly disengages the cutting tool and lifts it high enough over the master templet and stock to facilitate positioning the tooling for making inside cuts. The gag mechanism also stops the cutting action of the ram while material is being inserted. A small hand lever is moved to re-engage the gag mechanism and put the machine in operation.

The ram guide bearing has a micrometer adjustment for taking up wear and preventing side movement of the ram. This adjustment acts automatically in case the operator does not keep the micrometer screw tight. The construction guards against dulling of the tools from misalignment or lost motion.



Gray Metal Cutter with Turret Head that Facilitates the Handling of Stock

The machine is built in several sizes for nibbling stock from the lightest gages up to plate 1 inch thick. The new model can also be quickly converted into a shearing machine for metal up to 1/8 inch thick. Intricate shapes can be cut with the shearing attachment. Arms at the sides of the machine can be set at any angle to support the sheet or plate being cut. At the front of the machine is shown an attachment used for cutting rings, disks, and round blanks of various sizes to the required degree of accuracy.

Dings Magnetic Friction Clutch and Clutch Coupling

The Dings Magnetic Separator Co., Milwaukee, Wis., has developed a simple magnetic friction clutch having contact faces on both sides of a spring disk. These sides are squeezed between the magnet and armature elements when the coil is energized. Theoretically, this clutch can transmit double the power possible with a single friction-contact face, but there is said to be actually about 75 per cent greater torque with the same magnet strength.

Provision is made to compensate for wear of the contact faces. Light springs act upon the armature when the coil is de-energized to insure clearance between the two clutch elements. The clutch is made with or without ball bearings between the hubs of the clutch members.

A single-spring disk clutch of the same general construction, but having three friction contact faces to provide increased torque, has also been developed. The friction wearing faces of these clutches are composed of a hard tough asbestos compound that is formed to fit the disk faces and is riveted to them. In common installations, the magnet element is mounted on the driving shaft and the disk element is the driven member. However, the clutch mounting can be reversed.

The same company has also placed on the market a magnetic clutch coupling with serrated contact faces. The advantages claimed for this construction are that when the clutch coupling is energized, it will not creep, and that adjustments remain fixed within the torque limits of the clutch. This device is especially suitable for installation in rolling mills.

Gould & Eberhardt "Industrial" Shapers

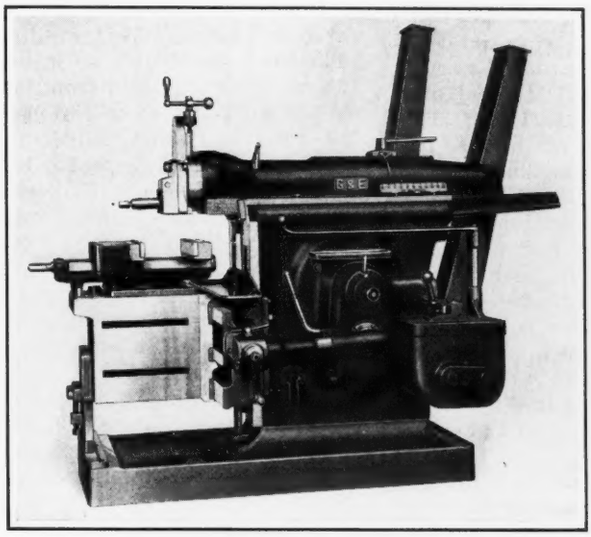
Twenty-two models are included in a new line of crank shapers designated as "Industrial," which has been developed by Gould & Eberhardt, Newark (Irvington), N. J. These shapers are intended to serve all industries. Sizes with a stroke of from 16 to 32 inches, inclusive, are available. One of the main features of these shapers is a built-in rapid power traverse to the table. This traverse operates in a direction opposite to that for which the feed is set. The traverse in either direction is at the rate of 100 inches per minute. A self-releasing control automatically reinstates the feed, and a safety device prevents damage.

Another important feature is an automatic cross-feed to the table, which is operated by a single cam, synchronized with the return stroke of the ram. Sixteen feed changes are available ranging from 0.012 to 0.200 inch. A direct-reading dial indicates the feed. The direction of feed is controlled at the rail. The safety device regularly provided for the rapid traverse mechanism prevents damage in case the table should be fed to the extreme ends of the rail.

There is a new type of lock for the tool-head, which is operated by a single control. The vise is of an improved design, with jaws projecting over one side of the table to permit end-shaping. Either single- or double-screw vises may be provided. A circulatory pressure system of lubrication is incorporated in the machine. With this system, there is a constant circulation of oil to the ram guide-ways and to the entire linkage system, including the sliding block and pin.

The double crank-gear transmission which has been embodied in Gould & Eberhardt shapers for over thirty years has been retained. The two-crank-gear terminus provides a wide range of strokes without excessive gear speed. All gears are of the helical type. A "Non-Slip" support guides and supports the front end of the table. It is positively locked by an adjustable stress block. There is a hole in the frame, as in previous models, to enable long shafts to be keyseated with the work close to the tool.

The shapers of this new line are regularly furnished with a single-pulley belt drive, the pulley being mounted on Timken bearings. However, machines may be made for a direct-connected motor drive through gears, multiple V-belts, or chains. The starting clutch and brake are operated through a single control. The shapers have an unusually low operating height.

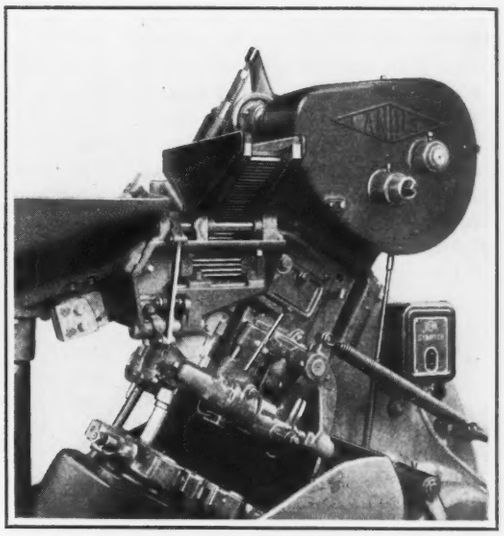


Gould & Eberhardt Shaper with Power Rapid Traverse for Table and Automatic Cross-feed

Stud Attachment for Landis Forming and Threading Machine

An attachment for handling studs has been designed by the Landis Machine Co., Inc., Waynesboro, Pa., for use on the 3/4-inch automatic forming and threading machine built by that concern. This machine was described in October, 1929, MACHINERY, page 110. The new attachment enables an unusually high production to be obtained, owing to the fact that the loading (and unloading), pointing, and threading operations are performed simultaneously at three separate stations. Another advantage of the attachment is the fact that it enables sheared blanks to be handled. This saves material, eliminates cutting-off operations, and reduces the manufacturing cost.

The attachment consists of a hopper and a magazine. An agitator at the base of the hopper insures an orderly and uninterrupted flow of blanks to the magazine. From the magazine, the



Landis Automatic Forming and Threading Machine Equipped with Stud Attachment

blanks are fed, one at a time, to a slot through which they drop into an auxiliary magazine. The auxiliary magazine is a sectoral chamber which brings the blanks in the proper position to be transferred to the loading station of the turret.

For the second or pointing operation, the semi-finished studs are stacked in the hopper with their blank ends at the front wall. This wall is hinged and can be dropped to facilitate loading. The pointing head takes care of variations in the length of the blanks and therefore insures studs of uniform length, with minimum waste.

The attachment is a self-contained unit which can be quickly applied to machines in service. It is adjustable to accommodate studs from 1/4 to 3/4 inch in diameter and from 1 1/2 to 6 inches in length, with a maximum thread length of 2 1/2 inches. The unthreaded section of the stud cannot be less than 75 per cent of the diameter.

Ramsey-Pulvis Clutch

An automatic starting clutch designed to permit the driving motor or other prime mover to come up to speed without load is being placed on the market by the Ramsey Chain Co., Inc., 1039 Broadway, Albany, N. Y., this concern having obtained exclusive rights for the manufacture and sale of the clutch in the United States. Other advantages of the Ramsey-Pulvis clutch are that it gives protection against overload shocks and eliminates

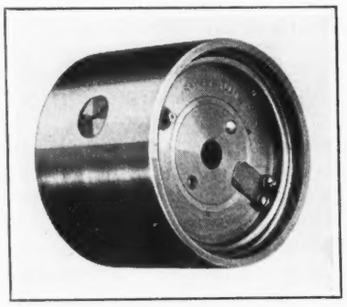


Fig. 1. Ramsey-Pulvis Automatic High-speed Clutch

the transmission of working strains.

The Pulvis principle consists of the gradual transmission of power by increasing the density of a mass of hardened steel shot against the driving and driven elements of the clutch through the action of centrifugal force. The principle is illustrated diagrammatically in Figs. 2, 3, and 4. When the rotor and shell or housing are at rest, the mass of shot lies at the bottom of the housing, as indicated in Fig. 2. When the motor is started, the clutch rotor which is keyed to it, has a shoveling action on the shot, as shown in Fig. 3. The housing remains for the moment at rest.

Each wing of the rotor alternately lifts a mass of the shot to a horizontal position and then dumps it back to the bottom through an opening. Much of the shot also escapes through the clearances around the wings. Gravity momentarily controls the action of the shot. However, as the motor speeds up, the centrifugal force increases. The rotor reaches full speed with the housing still at rest. Then the shot, swept to the grooves by the wing tips, causes the shell to begin turning.

The slowly accelerating shell brings about a second centrifugal force on the shot. This effects a true division of the shot mass between the two wings and thus balances the unit. When the centrifugal force at the grooves equals the force of gravity, the shot is carried through a complete revolution without being dropped. Then layers of shot are swept into the grooves and remain in place. As the shell speed increases, the centrifugal force overcomes the action of gravity at an increasingly shorter radius. The loose shot builds up in balanced formation on the front face of the wings and is held in place by centrifugal force. Finally the shell revolves at full speed in balance with the shot, as indicated in Fig. 4. The clutch passes through all these stages in a few seconds.

This clutch can be part of the driving member of a silent or roll chain, a flat belt, a multiple V-belt, or a gear drive, or it can be used as a coupling in direct-connected drives. Normal horsepower ratings of standard sizes range from 0.1 to 122 horsepower.

Electrode for Welding Aluminum

The Lincoln Electric Co., Cleveland, Ohio, has brought out an electrode known as the "Aluminweld," which is made from a 5

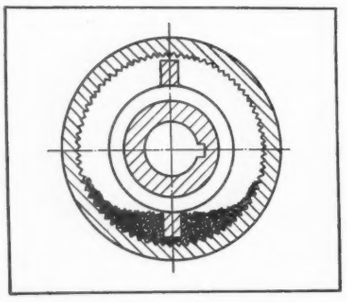


Fig. 2. The Rotor and Shell are at Rest with the Shot at the Bottom of the Shell

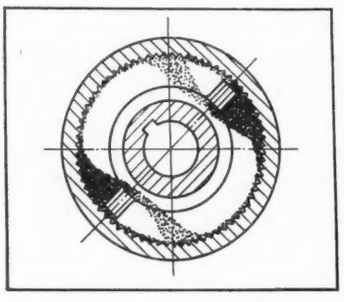


Fig. 3. After the Rotor Reaches Full Speed, the Shell Starts to Rotate

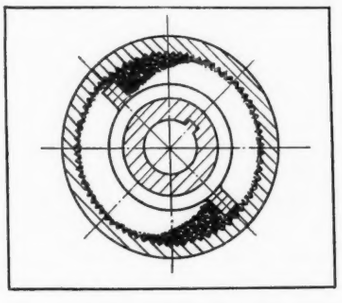


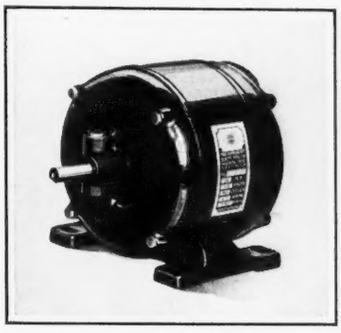
Fig. 4. When the Shell and Rotor Turn at Full Speed, the Shot is as Shown Here

per cent silicon-aluminum alloy. It can be used for welding sheet or cast aluminum, and is intended for either metallic or carbon arc welding.

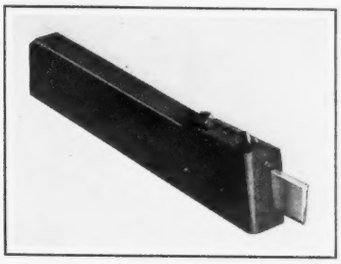
The electrode is provided with a coating that prevents excessive oxidation and dissolves any aluminum oxide that may be formed. The manufacturer claims that the coating assists in giving a very smooth operating arc. The resulting weld is dense without porosity, and possesses a high tensile strength. It can be polished with practically no discoloration. The electrode is produced in 3/32-, 1/8-, 5/32-, and 3/16-inch sizes and in 14-inch lengths.

Fractional-Horsepower Motors with High Starting Torque

Fractional-horsepower motors designed for starting loads slightly in excess of twice the full load torque when operated on their normal voltage have been developed by the Sunlight Electrical Mfg. Co., Warren, Ohio. These motors conform to the basic principle and construction of the DeLuxe series made by the concern. They embody the same switch mechanism and over-size bearings, and are made in 1/8, 1/6, 1/4, and 1/3 horsepower sizes for 110-volt, 60-cycle alternating current. A maximum temperature rise of 40 degrees C. is claimed for constant duty under full-load conditions.



Sunlight Fractional-horsepower Induction Motor with High Starting Torque



"Four Grip" Cutting-off Tool, the Blade of which is Gripped on Four Sides

"Four Grip" Cutting-Off Tool

A cutting-off tool in which the bit or blade is held on all four sides, so that heavy cuts can be taken without shifting of the blade, is being placed on the market by the Four Grip Tool Co., 107 E. 17th St., Paterson, N. J. The tool is made in straight, right-hand, and left-hand styles, and in nine sizes for lathes from the bench type up to the heaviest.

From the illustration it will be seen that the bottom edge of the blade is ground to an included angle of 60 degrees. It fits into a corresponding groove in the holder. The blade is first slid loosely into place in the holder and set-screws then bind the blade firmly through the medium of a V-block, as in other Four Grip tools. The V-block forces the blade against the opposite side of the slot and, at the same time, downward into the 60-degree groove, insuring a rigid and centralized blade. The blades are made of high-speed drawn steel and are ground on the top and bottom.

Crescent Junior Tape-Rule

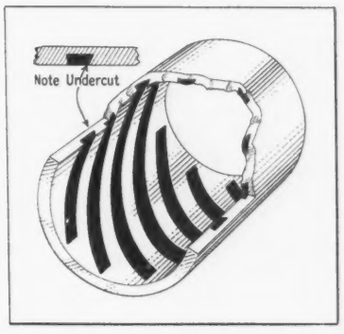
The Crescent Junior tape-rule now being placed on the market by the Lufkin Rule Co., Saginaw, Mich., is a counterpart of the Crescent tape-rule described in July, 1931, MACHINERY, page 888. The new rule, however, is smaller and lighter in weight, and it is made in both 4- and 6-foot lengths. The weight of the 4-foot size is only 3 ounces, and the chromium-plated case is 1¾ inches in diameter.

The blade is 7/16 inch wide and can be projected unsupported to ceilings or into openings, the same as an ordinary rule. It can also be used for measuring around circular and odd-shaped pieces. The blade is made of tempered steel and stiffened by special forming.

Williams Spiral-Type "Oil-Less" Bearings

Bronze bearings having spiral grooves filled with graphite have been added to the line of "Oil-Less" bearings made by E. A. Williams & Son, Inc., 105-111 Plymouth St., Jersey City, N. J. This spiral type of bearing is designed particularly for sliding or oscillating vertical and horizontal motions, as well as for full rotation of shafts at speeds up to 2500 revolutions per minute. The graphite lubricant functions satisfactorily at temperatures up to 1000 degrees F., making the bearings adaptable for use in furnace, baking-machine, and similar installations.

Attention is called to the under-cut feature of the grooves, which insures the retention of the graphite. The grooves are cut by machine, instead of being cast. This practice makes it possible to maintain an accurate ratio between the bronze bearing surface and the graphite surface. It also removes the danger of core sand remaining in the grooves, with the possibility of later



"Oil-Less" Bearings Made of Bronze with Graphite-filled Grooves

working through the lubricant and marring the shaft. Application has been made for a patent to cover these bearings.

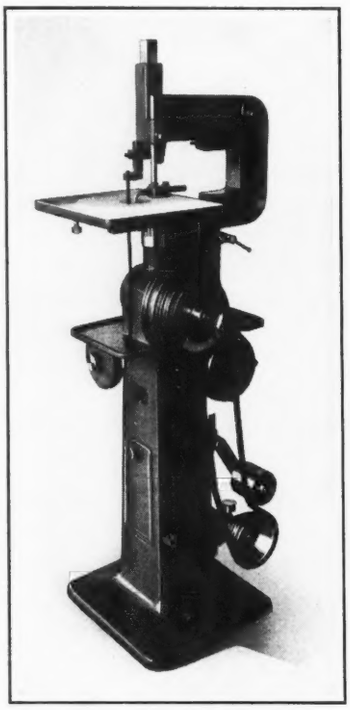
Aetna Oil Seal

A seal designed to hold both grease and oil in anti-friction bearings and to keep out grit, dirt, and water, has been placed on the market by the Aetna Ball Bearing Mfg. Co., 4600 Schubert Ave., Chicago, Ill. This seal will retain oil at low or high speeds and with the shaft in either a horizontal or a vertical position.

The seal consists of only four parts, and comprises a self-contained unit that can be easily slipped in or out of position. It has an outer shell of steel which is accurately formed and then ground on the outside diameter. The shell houses a seal cushion, pressure plate, and steel retainer.

The seal cushion is made of specially treated cork in which the interstices or air cells are hermetically sealed. This provides a pneumatic cushion that automatically expands and contracts laterally with the changing temperature of the shaft or lubricant, thus always remaining oil-tight. The fiber pressure plate deflects oil from the seal proper. It relieves the cushion of internal pressure and keeps it concentric with the shaft. The seal is made in sizes from 1/2 inch up.

Aetna Oil Seal Designed to Protect Anti-friction Bearings



Oliver Diemaking Machine which Uses Heavy or Light Tools

Oliver Redesigned Diemaking Machine

Improvements have recently been made in the P-4 model, pedestal-type diemaking machine built by the Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich., with a view to increasing its efficiency and facilitating operation. The machine here shown is equipped with a motor drive through V-belts. Five-step pulleys provide a like number of speeds.

This model is really a duplex machine, as it is arranged for holding either light or heavy files and saws. Clamps attached directly to the reciprocating rams hold the heavy parallel files. These clamps also hold adjustable clamps for small files and saws. The clamps are brought forward to simplify the inserting of files and saws. They can also be adjusted vertically to permit using the shortest file or saw possible for the work in hand.

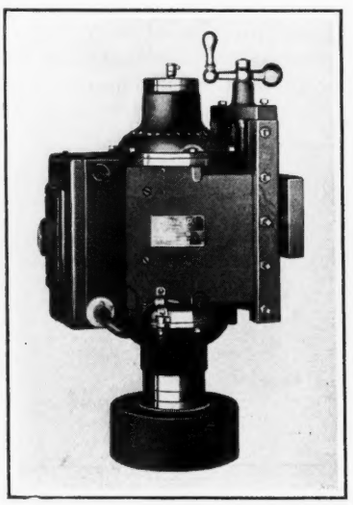
The over-arm, which is used both in filing and sawing, is of a design that eliminates the hold-down brackets, fingers, and file rollers required with previous models. The over-arm may be swung away from the file to remove the work for inspection and brought back into the same position instantly. It is not necessary to remove the file or loosen it in the lower clamp in order to inspect the work.

The upper arm is actuated through a bellcrank lever and two coil springs which exert a uniform tension on the saw. The table of the machine is supported on two brackets and tilts in four directions. Its working surface is ground. A magazine attached to the under side of the pan carries saw coils of various lengths.

This machine has a capacity for sawing tool steel up to 2 inches thick. In addition to the motor drive illustrated, a belt drive can be provided. The machine illustrated is equipped with a 1/2-horsepower motor and weighs about 400 pounds.

Vertical Grinding Attachment

The vertical grinder here illustrated was recently designed by the Standard Electrical Tool Co., 1938-46 W. 8th St., Cincinnati, Ohio, to be attached to planers and other machine tools. The size shown is driven by a special four-horsepower motor which runs at 3600 revolutions per min-



Vertical Grinder for Use on Planers and Other Machine Tools

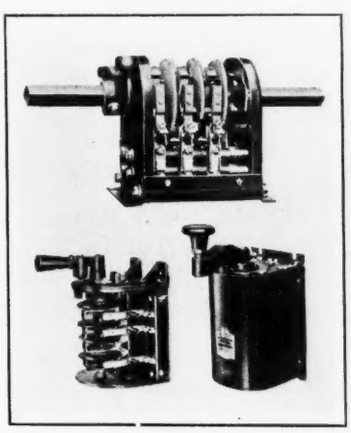
ute. The motor is controlled by a switch on the housing. S K F ball bearings are provided, and there is a special bearing to take the end thrust. The machine is equipped with a cup-wheel 7 inches in diameter, having a 1 1/4-inch wall. It can be furnished with both horizontal and vertical feeds.

This type of equipment is especially adapted for grinding dies or for surface grinding on a planer or boring mill. It is made in sizes from 3 horsepower up to and including 10 horsepower.

Cutler-Hammer Drum Controllers

A new line of alternating- and direct-current across-the-line reversing drum controllers has been brought out by Cutler-Hammer, Inc., 264 N. 12th St., Milwaukee, Wis., for monorail hoists, auxiliary machine tool motors, and other miscellaneous applications.

These controllers are made in various combinations to meet almost any requirement. They are made in two- and three-pole types, with a radial or rope-lever operating mechanism, with a self-centering and non-self-centering mechanism, and with or without main-line limit-switch protection or pilot circuit interlocks. The illustration shows several of the available types. These controllers are easily operated, of compact design, and light in weight.



Several Types of New Cutler-Hammer Drum Controllers

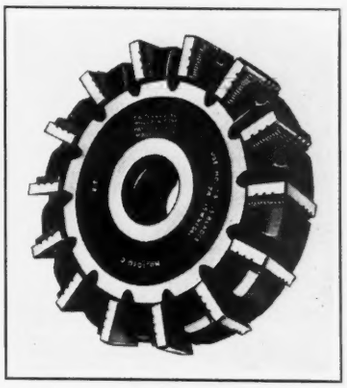


Fig. 1. O. K. Milling Cutter with Stellite Blades

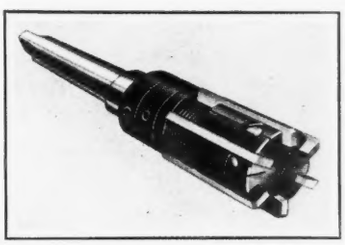


Fig. 2. O. K. Solid-shank Expansion Reamer

O. K. Tool Bits and Cutters

The square tool bits now being introduced on the market by the O. K. Tool Co., Inc., Shelton, Conn., have the same metallurgical characteristics as the line of cutter-blade inserts made by the concern. These bits are ground to fit any make of square-bit toolholders. The range of carbon in the steel from which the bits are made is permitted to vary only between 0.68 and 0.70 per cent. Like other tools made by the concern, these square bits are drop-forged.

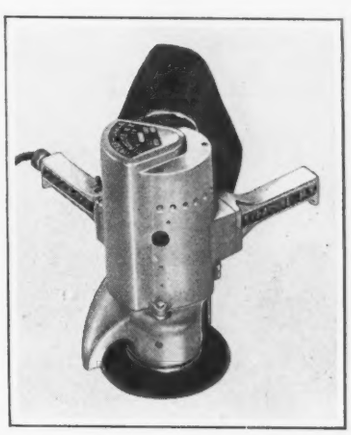
The O. K. Tool Co. has also brought out a Stellite cutter-blade designed with the essential features of the serrated cutter-blade made by the concern. This Stellite blade is backed up by an adjustable wedge, as seen in Fig. 1, which interlocks with the blade by means of mating grooves. By changing the relative positions of the wedge and blade grooves, the blade can be adjusted either axially or radially, or both. This adjustment allows compensation for wear, both on the outside diameter and face of the cutter. The new blade is obtainable in either Stellite or Stellite J-Metal. The cutter bodies are drop-forged from chrome-nickel steel and are heat-treated. Face- and end-mills are available with these blades.

Fig. 2 shows a solid-shank expansion reamer, which has also been added to the products of the O. K. Tool Co. This tool was designed as an adjustable sizing reamer for finishing operations. It comprises high-speed steel blades and a drop-forged chrome-nickel steel body. The blades are locked by a conical wedging screw which spreads the split body against the blade. The blades have a negative spiral and are spaced irregularly to insure fine finishing.

This reamer is made in standard sizes, right- and left-hand types, and also with special shanks, angles, sizes, and lengths. Each reamer has a practical range of adjustment.

Porter-Cable Dustless Disk Sander-Grinder

A portable disk combination sander and grinder with a self-contained vacuum system for disposing of the dust produced in operations is shown in the accompanying illustration. This sander-grinder is a recent development of the Porter-Cable-Hutchinson Corporation, Syracuse, N. Y. In the metal-working industry, it is especially suitable for such op-



Porter-Cable Sander-Grinder with Dust Disposal Feature

erations as preparing automobile bodies for welding, grinding down welds, smoothing castings, and finishing other metal surfaces. It can be conveniently suspended from an Emmons balancer, so as to relieve the user entirely of its weight.

The device is driven by a universal motor of one horsepower capacity. The dust is drawn through a passage that is completely sealed from the motor. The weight of this equipment is 21 pounds. It has a 7-inch disk. The no-load and cutting speeds are 3700 and 3200 revolutions per minute, respectively.

Baird Bench-Type Tilting Tumblers

A tilting tumbler designed especially for handling small quantities of work has been placed on the market by the Baird Machine Co., Bridgeport, Conn. This tumbler is of such a size that it can be mounted on a bench and driven by a belt or motor. It can be used for various kinds of tumbling operations, including ball burnishing.

While the barrel illustrated is a casting, barrels can be furnished in different materials and in various shapes and sizes to suit the work. More than one barrel can be used with one tumbler if desired. The barrel is held by a simple notched segment and locking-bar arrangement. It can rotate at any one of eight angles from a vertical position to an inclination of 20 degrees below the horizontal.

Baird Bench Tumbler Made in Belt- and Motor-driven Models

This bench tumbler has a net weight of 130 pounds, including the barrel and motor. Without the barrel, the net weight of the equipment is 55 pounds. The barrel has a capacity of from two to three quarts. The motor is of 1/8 horsepower rating and runs at 1725 revolutions per minute.

Thor High-Speed Rotary Air Grinder

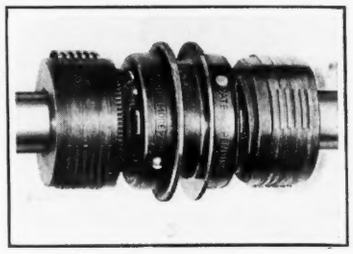
The Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill., has added a high-speed rotary air grinder to its line of pneumatic tools. This grinder is known as the Thor 255-X. It is designed to operate cone-shaped grinding wheels at a speed of 10,000 revolutions per minute. The outside diameter of the wheels is 2 3/4 inches.

This grinder is suitable for use on castings and forgings when ordinary emery wheels are not applicable. The weight of the grinder is 8 3/4 pounds. It has an over-all length of 19 1/4 inches.

Rotary Air Grinder which Drives Cone-shaped Wheels at 10,000 Revolutions per Minute

Cromaloy Flux

A flux known by the trade name of "Cromaloy," which is intended for use in welding the chromium alloys generally known as stainless steels or rustless irons, has been brought out by the Linde Air Products Co., 30 E. 42nd St., New York City. The advantages claimed for this flux are a high solvent power for the refractory chromium oxide and a high resistance to heat which protects the molten metal and the hot metal adjacent to the weld from oxidation.



Morse Pullmore Multiple-disk Friction Clutch

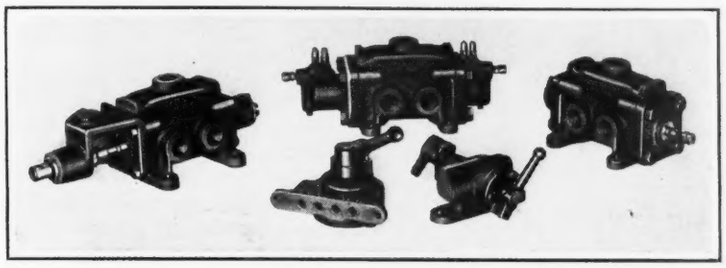
Morse Pullmore Clutch

The Morse Chain Co., Ithaca, N. Y., has been appointed exclusive sales agent for the Pullmore clutches manufactured by the Rockford Drilling Machine Co., Rockford, Ill. Both these concerns are divisions of the Borg-Warner Corporation.

The Pullmore clutch is a multiple-disk friction drive unit, made in six standard sizes having horsepower ratings of from 2 to 25 at a speed of 500 revolutions per minute. Single and double styles are manufactured, the double style being shown in the illustration. The clutch can be furnished to operate dry or in an oil bath. All parts are made of steel and are hardened and ground where required.

Vickers Four-Way Hydraulic Valves

The outstanding feature of the line of four-way hydraulic valves made by Vickers, Inc., 7746 Dubois St., Detroit, Mich., is a "hydraulic balance" that is said to make it impossible for the valves to bind due to pressure. This insures sensitive operation. These valves are intended for application to machine tools and other



Vickers Four-way Hydraulic Valves for Machine Tool and Similar Applications

hydraulically operated equipment. They are suitable for operating pressures up to 2000 pounds per square inch.

These four-way valves are made in three types. The type at the left in the illustration is a latch-controlled valve, which makes one complete cycle and then stops. This valve is particularly adapted for press operations, hydraulically operated furnaces, etc. The operator starts the machine manually in one direction; when the end of the stroke is reached, a stop trips a latch and allows an internal spring to shift the valve into the reverse position. At the end of the return stroke, the machine is stopped by the valve.

Manual and mechanical pilot valves constitute the center group in the illustration. These valves have a remote control without the use of levers, links, etc., and can therefore be placed out of sight or in the most convenient locations. Simple external adjustments control the reversing speed. The valve at the extreme right-hand end of the illustration is a manually operated type.

Dardelet "Rivet Bolt"

A "rivet bolt" designed as a fastening for applications that would ordinarily call for hot or cold rivets or body-bound bolts having a locking device is shown in the illustration. This "rivet bolt" is a recent product of the Dardelet Threadlock Corporation, 120 Broadway, New York City. It has a standard A.B.A. rivet head. The neck is ribbed the length of the grip, that is, a distance equal to the thickness of the plates to be held.

The threaded section, which has the Dardelet thread described in April, 1929, MACHINERY, page 631, is the nominal size of the bolt, whereas the ribbed section has an over-all diameter somewhat larger than the nominal bolt size. This diameter of the ribbed neck is approximately

Dardelet "Rivet Bolt" and Nut

1/32 inch greater than that of the punched or drilled hole in which it is to be used. When the bolt is driven home, the ribbed neck sets up a body-bound fit in the hole, maintaining a maximum bearing surface and thereby resisting displacement and allowing the development of the full shear value.

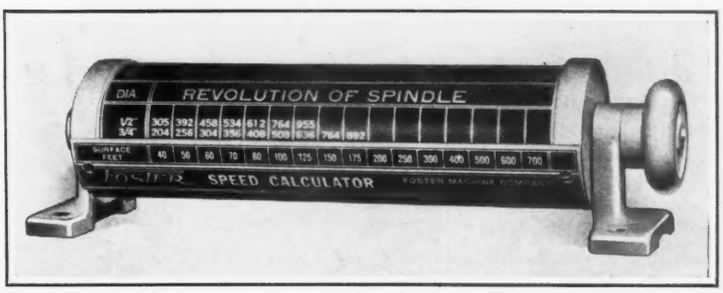
The nut is recessed to accommodate the end of the ribbed section when necessary. This allows for variations in the thickness of parts and increases the grip range of each standard bolt length. The locking action of the thread insures security against the nut backing off under vibration. The bolt is driven home with a few blows of a hand hammer, and then the nut is spun on and tightened with an ordinary wrench.

This "rivet bolt" has a wide field of application, including conveyors and other material-handling machinery, truck and bus bodies, cranes, and similar industrial equipment.

Foster Speed Calculator

A calculator now being placed on the market by the Foster Machine Co., Elkhart, Ind., is designed to help select the proper spindle speed for operations on almost any type of machine, such as the engine lathe, screw machine, milling machine, turret lathe, and drilling machine. It has a plate that lists the recommended cutting speeds, in surface feet per minute, for different kinds of materials. This plate enables the operator to select quickly the proper cutting speed for the material to be machined in cases where the speed has not already been determined by experience.

After the number of surface feet per minute has been decided upon, the proper spindle speeds, in revolutions per minute, for different diameters can be quickly determined. This is done by simply turning the drum of the calculator until the diameter of the work listed on the left-hand end is just above the "surface feet" plate. The proper spindle speed then appears directly



Calculator for Determining Spindle Speeds in Revolutions per Minute

above the speed in surface feet per minute that has been selected. Spindle speeds for milling cutters and drills are selected in a like manner by using the diameter of the cutter or drill in place of the work diameter. This calculator can be used advantageously in time-study and engineering departments, as well as in the shop.

The end of the calculator to which the "surface feet" plate is attached, may be turned so as to locate this plate in any desired position.

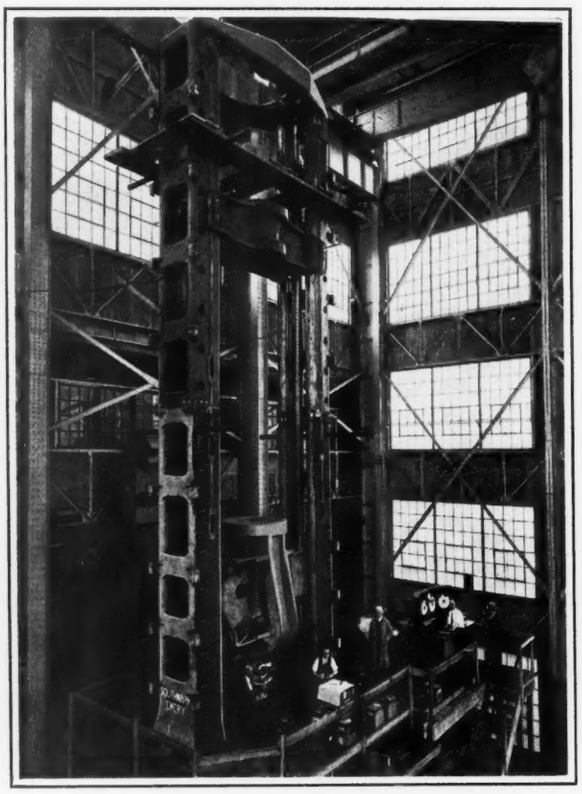
Nitriding Steel

A steel containing chromium and vanadium, which is said to offer an unusual combination of properties for nitriding purposes, has been developed by the Union Carbide & Carbon Research Laboratories, Inc. This steel is being introduced on the market by the Electro Metallurgical Co., 30 E. 42nd St., New York City. It possesses many of the physical properties found in the S A E 6100 series of steels. It contains from 0.50 to 2.50 per cent chromium, from 0.30 to 2.00 per cent vanadium, and carbon ranging from a very low percentage up to 0.70 per cent, depending upon the physical characteristics desired.

Testing Machine of Huge Dimensions

Compressive loads up to 4,000,000 pounds and tensile loads up to 3,000,000 pounds can be applied to columns 33 1/2 feet long in what is believed to be the largest testing machine in the world. This machine has just been completed by the Baldwin-Southwark Corporation, Eddystone, Pa., for the University of California. The distance between the columns is 10 feet, and the table is 12 feet long. The table will be level with the laboratory floor, so that a truck can be driven between the columns and the specimen l i f t e d directly from the truck body by the testing machine itself.

Loads are applied hydraulically by a ram 46 inches in diameter. The pressure is about 2500 pounds per square inch when the machine is operating at capacity. The ram is fastened to the table, the cylinder being the movable element. Compression tests are carried out between the lower cross-head and the table, while tension tests are made between the upper cross-head and the yoke around the lower cross-head. The machine stands 46 feet 9 inches above the floor line. It has a total weight on the foundation of about 475,000 pounds. Because of the great height of this machine, provision has been made for installing an elevator in connection with it.



Testing Machine that Applies Compressive Loads up to 4,000,000 Pounds and Tensile Loads up to 3,000,000 Pounds

Machine Tool Builder to Stage Exhibition

Confidence in the early revival of industrial activity is evidenced by the large demonstration and exhibition of new models of machine tools to be held at the plant of the American Tool Works Co., Cincinnati, Ohio, during the week beginning March 7. On this occasion, the new American 22-inch 100-horsepower Super-Lathe will be publicly shown and demonstrated for the first time. In addition, there will be twenty-three of the latest types of lathes, radial drills, and shapers on exhibition. These machines have been designed to suit the speeds and feeds demanded by the most advanced types of cutting tools.

The outstanding feature of the demonstration will obviously be the performance of the new Super-Lathe which has been developed for the General Electric Co., primarily for the testing of cemented carbide tools, in order to establish maximum practicable speed and feed rates for the cutting of different kinds of metals. This lathe represents a radical departure from long established principles of lathe design; and although its swing is only 22 inches, it is designed ruggedly enough to transmit the full capacity of its 100-horsepower motor to the point of the tool.

* * *

According to the annual suggestion report of the General Electric Co., 19,595 suggestions were made by employes of the company during the past year—an average of 428 suggestions for every 1000 employes. Of these, 6383 had sufficient merit to be adopted—approximately one-third of the suggestions made. A total of $55,739 was paid in awards. The highest sum paid was $1000, which was paid to an employe at the Erie, Pa., plant. The average award paid was $8.75.

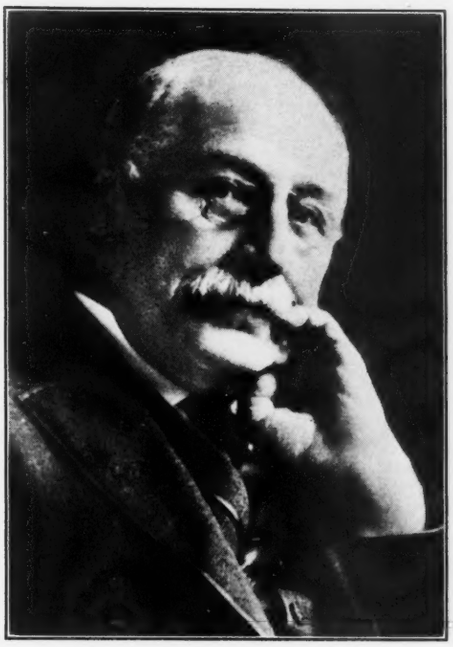
Henry E. Eberhardt Celebrates Eightieth Birthday

On February 14, Henry E. Eberhardt, president of the Newark Gear Cutting Machine Co., Newark, N. J., celebrated his eightieth birthday. Born in Newark in 1852, he graduated from the Newark public schools at the age of thirteen, and immediately began to serve a five-year apprenticeship with Ezra Gould. Later, with his brother, he became one of the partners in the firm of Gould & Eberhardt.

In the early days, all gears were cut by hand, and the cutters were also made by hand. Mr. Eberhardt first developed a semi-automatic machine for making cutters used in cutting gears and later developed gear-cutting machines. In 1904, he left the firm of Gould & Eberhardt, and, with his five sons, formed the Newark Gear Cutting Machine Co. of which he has ever since been president.

Mr. Eberhardt is a director of the American Gear Manufacturers' Association and a past director of the Newark Chamber of Commerce. His hobbies, next to automatic machinery, are photography, astronomy, and books. He has five children living, twelve grandchildren, and two great grandchildren. He is widely known in the machinery field, and his friendly, sincere personality has won him a host of friends in the industry.

Mr. Eberhardt has always been guided by this motto: "To rest is to rust." He has always been active in the field in which he is engaged, and, in addition to his work in the development of gear-cutting machinery, he has been granted many patents on a variety of machine tool developments and on printing machines, especially for the printing of United States currency. He also has developed many new shop methods.



Henry E. Eberhardt, President of the Newark Gear Cutting Machine Co., who just Celebrated his Eightieth Birthday

Surfacing Metal with Rubber

The availability of rubber latex, the form in which it is now largely shipped from the plantation to the consumer, has revolutionized the art of lining and covering utensils, parts, and fittings of all sorts for the chemical engineer with that protective material. The work is being done variously by dipping and by what is known as electro-phoresis — a process that, however, cannot yet be said to have reached a commercially successful stage.

Among the manufacturers who have taken the lead in this branch of industry is Nordac, Ltd., of Harrow, England. This firm has specialized in lining and coating equipment with soft rubber, and has developed a system of applying the latex by an air-operated spray gun. For this purpose the latex, which is stabilized with ammonia, is mixed in a mill with adhesives, accelerators, sulphur, curing agents, and pigments, depending on the service to which the articles treated are to be put. To insure a perfect bond, all metal surfaces are first freed of dirt and rust by sand-blasting or other suitable means. Coatings or linings, varying in thickness from 1/32 to 1/16 inch, are built up quickly—as many as eight films being applied with short drying intervals between successive layers. With the spraying finished, the rubber is vulcanized. The process promises to have wide application in many fields.—*Compressed Air Magazine.*

Men in the Industry

W. A. OLEN, president and general manager of the Four Wheel Drive Auto Co., Clintonville, Wis., has been elected a member of the board of directors of the Manufacturers' Division of the American Road Builders' Association.

CLARENCE E. SEARLE, general representative of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., has resigned to make another connection. He will be succeeded by L. W. GROTHAUS who has been affiliated with the company for twenty-eight years.

FRED BASKERFIELD has retired as manager of the railway division of the Crucible Steel Co. of America in the western territory, and will be succeeded by FRED T. CONNOR, for the last eight years district sales manager of the Pittsburgh Crucible Steel Co. at Chicago.

FRED ARCHER, formerly president of Fred Archer, Inc., has been placed in charge of motor sales at the Philadelphia office of the Lincoln Electric Co., Cleveland, Ohio. Mr. Archer was with the White Motor Co. and the Kelly-Springfield Tire Co. before forming his own concern.

B. F. MCINTYRE, formerly with the Industrial Controller Co., Milwaukee, Wis., is now connected with the Chicago office of the Lincoln Electric Co., Cleveland, Ohio, in charge of motor sales for the Chicago district. Mr. McIntyre's electrical engineering education was obtained in Toronto, Canada.

FRANK J. DUMARS has recently joined the sales staff of the machine and small tools divisions of the Barber-Colman Co., Rockford, Ill., as representative for the central western states, specializing in dies, jigs, and fixtures. Mr. DuMars was previously connected with the Reynolds Engineering Co., Rock Island, Ill., in a sales capacity.

FREDERICK B. HEITKAMP has recently been advanced from the position of sales manager of the Cincinnati Milling Machine Co., Cincinnati, Ohio, to the post of general sales manager of the Cincinnati Milling Machine Co. and the Cincinnati Grinders, Inc. Mr. Heitkamp has been associated with the Cincinnati Milling Machine Co. since 1921.

MAX AMS, president of the Max Ams Machine Co., Bridgeport, Conn., has assumed complete personal direction of sales. All sales offices are now consolidated at Bridgeport, where all correspondence should be sent. Julius Brenzinger continues as vice-president in charge of development and product, and in addition has assumed full direction of the factory.

DONALD L. MCCUBBIN, formerly assistant manager, has been appointed manager of the Cincinnati plant of Joseph

Donald L. McCubbin

T. Ryerson & Son, Inc., Chicago, Ill. Mr. McCubbin has been connected with the Chicago plant of the concern for nine years, and previous to that was at the Cincinnati plant for seven years. LEWIS E. SKINNER returns to the Chicago sales organization to take over a special sales department.

W. A. ROSENBERGER has been appointed chief engineer of the Pangborn Corporation, Hagerstown, Md., manufacturer of blast cleaning and dust collecting equipment. Mr. Rosenberger was born in Switzerland, and graduated in 1909 from the Polytechnic Institute at Zurich. For twenty years he has specialized in blast cleaning and dust collecting equipment.

EVERETT D. GRAFF, for some years a vice-president of Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill., was elected first vice-president at a recent meeting of the board of directors. ROBERT C. ROSS, formerly assistant to the president in charge of plant operations, was elected vice-president. HAROLD B. RESSLER, general manager of sales, was also elected a vice-president.

Everett D. Graff

FRED A. BENNETT, who has been connected with the Marshall & Huschart Machinery Co. for the last seven years, has been appointed resident salesman in South Bend, Ind., from which point he will cover the Indiana and Michigan territory. H. D. GENTRY, who has been with the company for the last six years, will act as resident salesman in Moline, Ill., covering the Iowa territory and a portion of southern Illinois.

CHARLES N. STODDARD has been elected president and general manager of the Greenfield Tap & Die Corporation, Greenfield, Mass., succeeding FRANCIS G. ECHOLS, who has retired after having been connected with the tool-manufacturing business for over forty years. Mr. Stoddard, a Greenfield attorney, who is a director of several New England financial and industrial corporations, will devote his exclusive time and attention to the duties of his new office. He has served as general counsel and as director of the Greenfield Tap & Die Corporation since its formation, and held the office of vice-president for the past year. He is a graduate of Williams College and has a long and varied experience in the financial and industrial field, as well as in the legal profession.

C. E. WILSON, for the last nine years general sales manager of the Worthington Pump & Machinery Corporation, Harrison, N. J., has been appointed vice-president in charge of industrial relations. CLARENCE E. SEARLE, for seventeen years general representative in charge of sales for the Allis-Chalmers Mfg. Co., Milwaukee, Wis., has been made vice-president in charge of sales. WILLIAM H. BAUMES, who has been treasurer of the Worthington Pump & Machinery Corporation for fourteen years, has retired. CHARLES N. BARNEY, for the last fourteen years secretary and general counsel of the company, has been appointed secretary, treasurer, and general counsel. A. L. PRENTICE, formerly assistant comptroller, has been appointed assistant treasurer. WALTER LEHMAN continues to hold the position of assistant treasurer in charge of credits. FRANK D. TALMAGE, formerly a member of the counsellor's staff, has been appointed assistant secretary.

J. E. CASTER has been made manager of the newly opened Pittsburgh office of the Cincinnati Milling Machine Co. and Cincinnati Grinders, Inc., at 2737 Koppers Bldg., Pittsburgh. Mr. Caster became affiliated with the Cincinnati Milling Machine Co. in 1916, and in 1925 was transferred to development and sales work on Cincinnati centerless grinders. In 1929 he was made assistant

Carl G. Liljeberg

sales manager of Cincinnati Grinders, Inc., and last September was appointed manager of the Cleveland office, which position he will continue to hold in addition to his new work. CARL G. LILJEBERG has been appointed sales engineer, with headquarters at the Pittsburgh office. Mr. Liljeberg is a graduate of the University of Technology in Eskilstuna, Sweden. He came to the United States in 1923 and joined the E. G. Johansson, Inc., Division of the Ford Motor Car Co. as a tool and special machine designer. Later he was special designer for the Illinois Tool Works, Chicago, Ill. He has been associated with the Cincinnati Milling Machine Co. since April, 1929.

H. C. THOMAS has been appointed assistant to the general works manager of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Thomas was formerly director of manufacturing stocks. He has been connected with the company since 1910.

H. C. Thomas

When selecting equipment, remember that the tools you buy probably will be used for a long time. Brown & Sharpe Tools are always a wise selection. Their accuracy is recognized as standard throughout the world; their design gives them long life with exceptional handiness; their reliability has been proved in thousands of shops during nearly a century. Brown & Sharpe Tools offer every encouragement and aid to the fast production of quality work. Ask for small Tool Catalog No. 31. Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

Brown & Sharpe Tools

"World's Standard of Accuracy"

News of the Industry

WEIR KILBY CORPORATION, Cincinnati, Ohio, announces that the company has taken over the entire business of the CINCINNATI FROG & SWITCH CO., Cincinnati, Ohio.

DAVIS BORING TOOL CO., 6200 Maple Ave., St. Louis, Mo., has appointed the National Sales Engineering Corporation, 404 Lexington Bldg., Detroit, Mich., representative for the Michigan territory.

GEARS AND FORGINGS, INC., Cleveland, Ohio, have appointed Frick-Reid Supply Corporation, 117 Sandusky St., N. S., Pittsburgh, Pa., jobbers to handle the company's speed reducers in the Pittsburgh territory.

DARDELET THREADLOCK CORPORATION, 120 Broadway, New York City, has licensed the Reed & Prince Mfg. Co., Worcester, Mass., to manufacture and sell bolts, nuts, and screws that are threaded with the Dardelet self-locking thread.

BAKER BROTHERS, INC., Toledo, Ohio, manufacturers of drilling, keyseating, boring, and tapping machines, have appointed Crane-Schiefer-Owens, Inc., exclusive representative of the company for the Buffalo, Rochester, and Syracuse territory.

INDEPENDENT PNEUMATIC TOOL CO., 600 W. Jackson Blvd., Chicago, Ill., manufacturer of Thor electric and pneumatic tools and air compressors, is moving the Cleveland office from the Union Trust Bldg. to 1740 E. 12th St. Hayden F. White is manager of that office.

FEDERAL MACHINE & WELDER CO., Warren, Ohio, manufacturer of spot, butt, jump, and seam welders, announces that the company has registered a trademark symbolical of electric welding. This trademark has been featured in recent advertisements of the company.

GALVIN MACHINERY SALES, 500 Brisbane Bldg., Buffalo, N. Y., has been organized by H. E. Galvin, who was previously associated with Crane-Schiefer-Owens, Inc., metal-working machinery dealers. The new concern will deal in metal-working machinery.

BROWN TOOL CO., 10465 Carnegie Ave., Cleveland, Ohio, agent in the Cleveland territory for the Barber-Colman Co., Rockford, Ill., for several years, has taken over the distributing agency for the Barcol OVERdoor and Barber-Colman door-operating equipment, products of the electrical apparatus division of the Barber-Colman Co.

AMERICAN MACHINE AND METALS, INC., 100 Sixth Ave., New York City, announce the purchase of the TOLHURST MACHINE WORKS, INC., of Troy, N. Y., makers of Tolhurst extractors. The Tolhurst Machine Works will retain its own name and be a separate and distinct subsidiary of American Machine and Metals, Inc. The sales and executive offices will be at 100 Sixth Ave., New York City.

GUNITE FOUNDRIES CORPORATION is the name applied to a consolidation of the ROCKFORD NORTHWESTERN MALLEABLE CORPORATION and the GUNITE CORPORATION, both of Rockford, Ill. Duncan P. Forbes, who formerly served as president of both of the corporations, is president and general manager of the new concern. The new corporation will manufacture brake-drums, clutch pressure plates, connecting-rods, wrenches, and bolts.

KEARNEY & TRECKER CORPORATION, Milwaukee, Wis., announces that the Motch & Merryweather Machinery Co., 1315 Clark Bldg., Liberty at Wood St., Pittsburgh, Pa., has been appointed the exclusive sales representative for Milwaukee milling machines in the Pittsburgh and western Pennsylvania territory, which also includes West Virginia and eastern Ohio. E. F. Schroeder will continue to serve as direct factory sales and service man in Pittsburgh.

PRATT & WHITNEY CO., Hartford, Conn., has completed a series of demonstrations throughout the Middle West on new electric gaging methods. These demonstrations were held in Chicago and Rockford, Ill., Davenport, Iowa, and Milwaukee, Wis. The gage demonstrated was the Pratt & Whitney Electrolimit gage, which makes errors visible in a highly magnified form by the use of a magnifying electric circuit. Other Pratt & Whitney gages were also shown and demonstrated.

THE CINCINNATI MILLING MACHINE CO. and its subsidiary, CINCINNATI GRINDERS, INCORPORATED, Cincinnati, Ohio, and THE HEALD MACHINE CO., Worcester, Mass., have concluded a cooperative arrangement that will be mutually advantageous in the further development of their respective lines of manufacture. These companies have for a long period of years made very valuable contributions to the industries they serve, and they believe that by making the engineering research and grinding knowledge of each company available to the engineers of the other, a more complete service in internal and external grinding can be rendered to all users.

COMMERCIAL CENTERLESS GRINDING CO., 6538 Carnegie Ave., Cleveland, Ohio, has been organized by E. E. Blundell, formerly with the Cincinnati Grinders, Inc. The new company performs centerless grinding operations for firms who have no centerless grinding equipment or whose centerless equipment may temporarily be inadequate for their needs. The new plant has been in operation for four months; experience during this period has proved that it fills a need in the Cleveland territory.

SMITH POWER TRANSMISSION CO., Penton Building, Cleveland, Ohio, announces the establishment of a branch office at 626 Broadway, Cincinnati, Ohio, under the direction of Henry M. Wood. This office will handle engineering and sales service on Whitney silent and roller chain drives manufactured by the Whitney Mfg. Co., Hartford, Conn., as well as Flexoid industrial couplings, industrial variable-speed units, and other mechanical power transmission equipment manufactured by the Smith Power Transmission Co.

AMERICAN KRON SCALE CO., 430 E. 53rd St., New York City, has recently been reorganized, under the name of the KRON CO., in order to provide additional capital for use in broadening the lines of manufacture and increasing the activities of the company. The new company will be located at 1720 Fairfield Ave., Bridgeport, Conn. Richard F. Straw, formerly sales manager of the Wright Mfg. Co., has been made president of the new organization. The other officers are F. W. DeFoe, vice-president, and H. C. Stevenson, secretary and treasurer.

Obituaries

WILLIAM F. SCHWEIGERT, secretary of the Niagara Machine & Tool Works, Buffalo, N. Y., manufacturers of sheet-metal working machinery, died at his home February 9, at the age of fifty-nine. Mr. Schweigert had been identified with the sales activities of the company for over forty years, and was particularly well known in the steel barrel manufacturing industry.

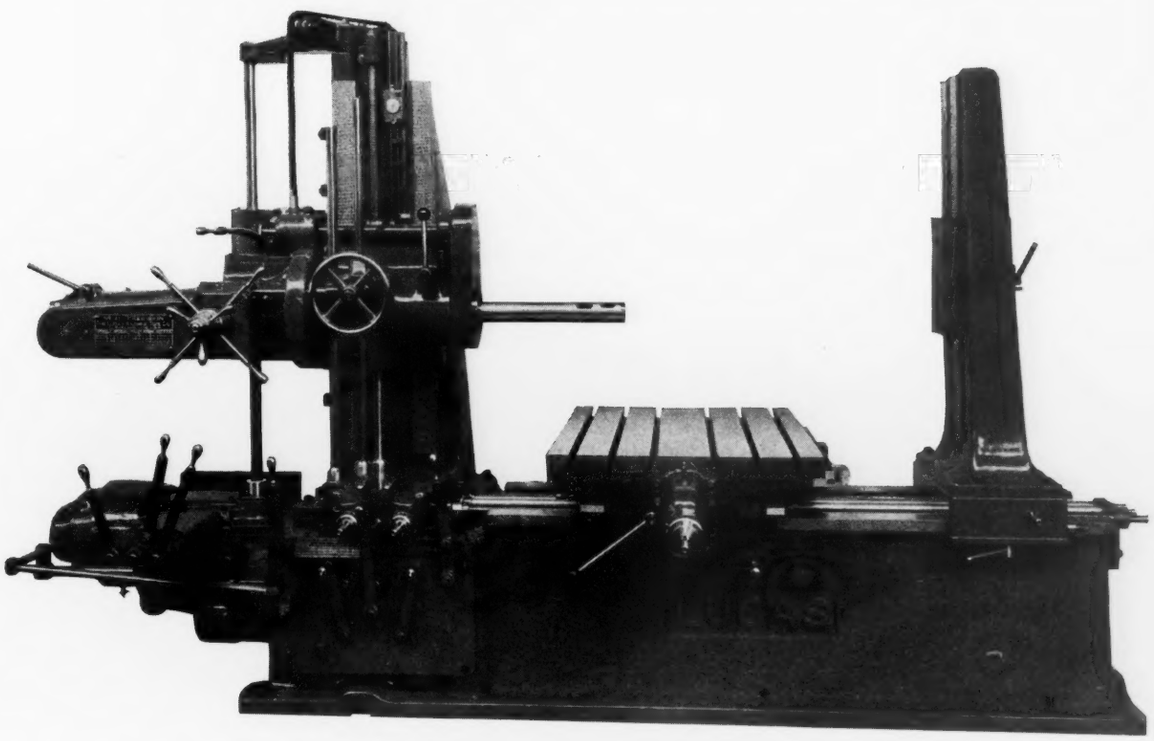
JACOB C. MATTERN, assistant superintendent in charge of equipment at the Elizabethport, N. J., plant of the Singer Mfg. Co., died February 7 at the age of sixty-six years, from injuries received in an automobile accident. Mr. Mattern was born in Pomeroy, Ohio, and while working as a machinist, graduated from the law school of the University of Cincinnati. Later he practiced law, but ultimately went back to the machinery

SPEED

1200 R.P.M.

for the 3 INCH MAIN SPINDLE of the
No. 41 LUCAS "PRECISION" Horizontal
Boring, Drilling and Milling Machine with

AUXILIARY HI-SPEED DRIVE



Also available with suitable high speeds for 4 inch and 5 inch spindle machines.

LET US TELL YOU MORE ABOUT IT
than space permits printing here.

THE LUCAS MACHINE TOOL COMPANY, Cleveland, O.

FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. Andrews & George Co., Tokyo. Catmur Machine Tool Corp., Ltd., London, Eng. M. Kocian & G. Nedela, Prague. V. Lowener, Copenhagen, Oslo, Stockholm. Emanuele Mascherpa, Milan, Italy. R. S. Stokvis & Zonen, Rotterdam, Paris.

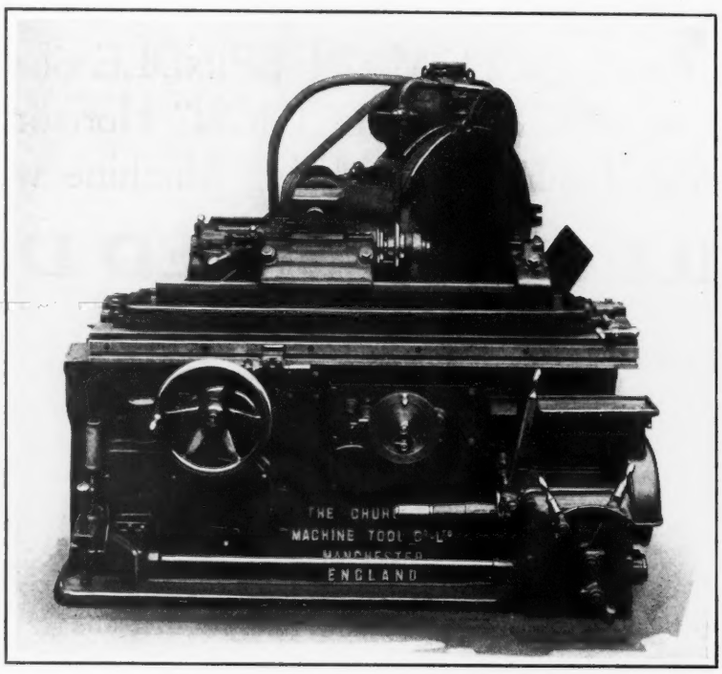
industry. He became associated with the Singer Mfg. Co. in 1911, and was made assistant superintendent in charge of equipment in 1920. During the war he was in charge of the manufacture of the recoil mechanism for the French 75-millimeter gun at the Singer plant.

Mr. Mattern was active in the civic affairs of his home town, Roselle, N. J., and was recorder for six years. He was a member of the American Society of Mechanical Engineers, and at the time of his death was chairman of the sectional committee for the standardization of leather belting. He was also a member of the Plainfield Engineers' Club.

Machine that Grinds Right-Angle Surfaces

Two adjoining surfaces, one a cylinder and the other a shoulder or flange, can be ground in a special machine equipped with only one wheel, which has recently been designed by the Churchill Machine Tool Co., Ltd., Broadheath, Manchester, England. The illustration shows such an operation being performed. The wheel-head of this machine is permanently positioned at an angle of 45 degrees in relation to the table. However, the hand-operated feed adjustment is in a direction at right angles to the table movement.

In operation, the table is fed to a dead stop, there being no automatic traverse. A sizing gage of the indicator type on the right-hand end of the bed facilitates set-ups and the positioning of the dead stop. The work is mounted on an expanding arbor, operated by a lever at the tail end of the work-head. All bearings are automatically lubricated, and the final drive is by spiral gearing, running in oil. Four work speeds are available through the gear-box. A diamond truing device is provided as regular equipment.



Machine for Grinding Surfaces at Right Angles to Each Other

Molybdenum and its Application

Molybdenum, a metal that has been known for one hundred and fifty years, has found general practical application only during the last twenty or twenty-five years. Molybdenum alloy steel came into prominence during the World War. It was used extensively in making light armor plate, helmets, and airplane engines, because of the great strength and hardness that it imparted to steel. It has been said that, with the exception of carbon, molybdenum is the most potent alloying element that can be added to steel. Ordinarily, it is used in very small percentages only.

For many purposes where tungsten is used, it can be substituted for tungsten, only half the percentage of molybdenum being required, as compared with tungsten. Even when used in percentages as low as 0.1 per cent, it has given to steel marked tendencies to resist corrosion. Thin-walled, high-strength, chromium-molybdenum steel tubing has made the modern high-speed airplane possible. No substitute has as yet been found for this material in the highly stressed members of the fuselage. The pure metal is also made use of extensively in the incandescent and radio bulb industry.

Cooling Arrangement for Welding a Soldered Joint

Although the welding of stainless steel is no longer difficult, an unusual application sometimes arises that constitutes more of a problem than the mere welding process. Such a problem presented itself recently, and its solution offers a possible aid to many others using this comparatively new alloy.

In making an Allegheny metal food container, a manufacturer wanted to solder the seam on the inside of the tank and weld along the outer flange for greater strength. The solder was applied in order to cover the seam smoothly and prevent food particles from becoming lodged in it. It was found, however, that after the welding operation had been performed, a hard oxide deposit in the seam prevented the solder from adhering. If the process were reversed, the high temperature required for welding (3200 degrees F.) would melt the solder, the melting point of which is 450 degrees F.

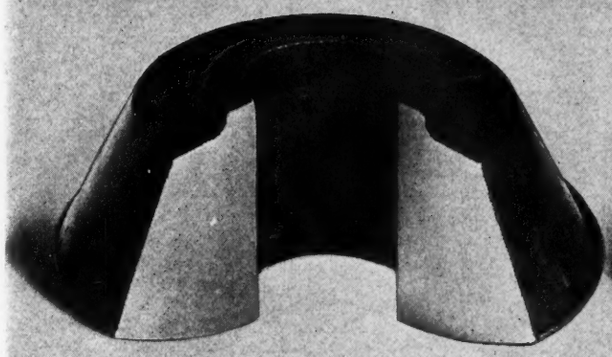
Engineers of Joseph T. Ryerson & Son, Inc., Chicago, Ill., suggested a plan that was successfully demonstrated before the Waukegan, Ill., Welding Society recently. To avoid the objectionable deposit of oxide, the tank was soldered and partly filled with water before welding. The water served to dissipate the intense welding heat and prevented the solder from melting. Ryerson Allegheny metal welding rod and a Type S Wilson welder were used in conducting this test. An Allegheny solder and special flux were used for the soldering.

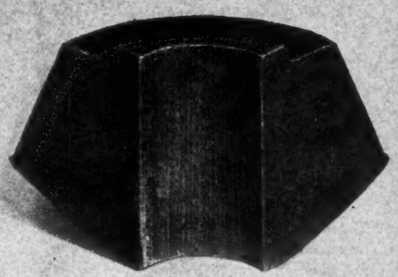
The World's Shipbuilding

Statistics recently published indicate a tremendous growth in the application of internal-combustion engines to ship propulsion. Of the vessels launched in British shipyards in 1931, twelve ships, with a total tonnage of 117,500, are propelled by steam turbines. Two vessels, with a total tonnage of 16,000, are fitted with a combination of reciprocating steam engines and turbines, while the ships fitted with internal-combustion engines aggregate 228,000 tons. Vessels provided with regular reciprocating steam engines totaled 141,500 tons.

Great Britain accounted for about one-third of the world's tonnage; the United States, for about 12 per cent; Italy, 10 per cent; Denmark and Holland, each about 7 per cent; and France, Germany and Sweden, each about 6 per cent.

PIERCED BEVEL GEAR FORGINGS





THESE bevel gear forgings, upset and pierced on *AJAX Upsetting Forging Machines*, offer unusual advantages. The three operation die is simple and rugged. In the first two operations the work is upset and partially pierced, nicking inserts simultaneously swaging the bar to the diameter of the hole preparatory to the punching operation.

The holes are straight, clean, concentric, and accurate in size. Only a minimum amount of machining is necessary to finish the gears on all surfaces.

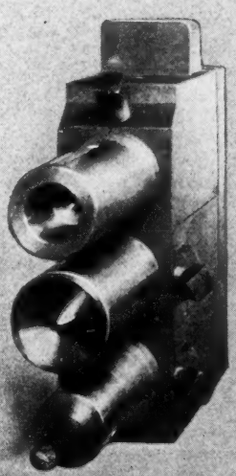
In addition, these forgings retain the excellent internal structure characteristic of all upset gears, i.e., uniform, unbroken fibre flow looping radially through every tooth.

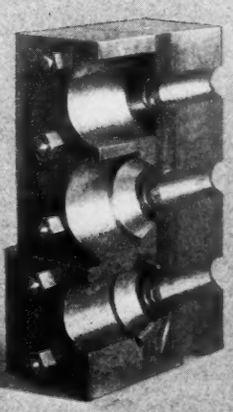
Ajax engineers, experienced in the design of upsetting dies, will gladly assist you in solving your forging problems.

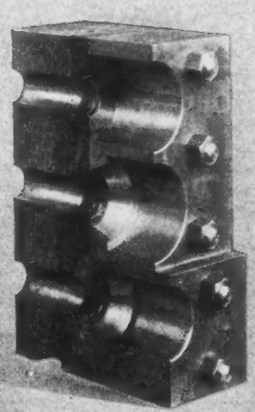
THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P.O., CLEVELAND

CHICAGO OFFICE: 621 MARQUETTE BLDG.







AJAX

Coming Events

MARCH 7-12—Packaging, Packing, and Shipping Exposition to be held at the Palmer House, Chicago, Ill., under the auspices of the American Management Association. Exposition headquarters, Room 602, 225 W. 34th St., New York City.

MARCH 9—Regional meeting of the American Society for Testing Materials at the Hotel Cleveland, Cleveland, Ohio. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

MARCH 17—Fifteenth annual meeting of the Electric Hoist Manufacturers' Association at the Hotel McAlpin, New York City. E. Donald Tolles, secretary, 165 Broadway, New York City.

APRIL 11-16—Ninth annual Oil Burner Show to be held in Mechanics Hall, Boston, Mass., under the auspices of the American Oil Burner Association, 342 Madison Ave., New York City.

APRIL 27-29—Annual meeting of the American Welding Society at the Engineering Societies' Building, 29 W. 39th St., New York. William T. Spraragen, secretary, 29 W. 39th St., New York City.

MAY 2-6—Thirty-sixth annual convention and exhibit of the American Foundrymen's Association to be held in the new Municipal Convention Hall, 34th St. and Vintage Ave., Philadelphia, Pa. Executive secretary, 222 W. Adams St., Chicago, Ill.

MAY 4-5—Management, Maintenance, and Materials Handling Meeting of the American Society of Mechanical Engineers to be held in Philadelphia, Pa., in conjunction with the Foundry and Industrial Equipment Exposition. Calvin W. Rice, secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York City.

MAY 12-13—Sixteenth annual meeting of the American Gear Manufacturers' Association to be held at the Hotel Statler, Cleveland, Ohio. The Executive Committee will meet at the same place, May 11. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

JUNE 20-24—Annual meeting of the American Society for Testing Materials at Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

JUNE 27-30—Semi-annual meeting of the American Society of Mechanical Engineers, jointly with the Canadian Institute of Engineers, at Bigwin Hotel, Lake of Bays, Highlands of Ontario, Canada. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SEPTEMBER 10-17—Machine Tool Exposition of the National Machine Tool Builders' Association, at Cleveland, Ohio. Boyd Fisher, general manager, 617 Vine St., Cincinnati, Ohio.

OCTOBER 3-7—National Metal Congress, Buffalo, N. Y., sponsored by the American Society for Steel Treating, 7016 Euclid Ave., Cleveland, Ohio, with the cooperation of the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Welding Society, and the Wire Association.

OCTOBER 3-8—Fourteenth annual National Metal Exposition to be held in the 174th Regiment Armory, Buffalo, N. Y. W. H. Eisenman, secretary, American Society for Steel Treating, 7016 Euclid Ave., Cleveland, Ohio.

New Books and Publications

THE DIMENSIONAL PROBLEM IN INTERNATIONAL STANDARDIZATION. By Luther D. Burlingame. 13 pages, 7 by 10 inches. Published by the American Institute of Weights and Measures, 33 Rector St., New York City.

MONEL METAL BOLTS—Outline of Properties. 8 pages, 8½ by 11 inches. Published by the International Nickel Co., Inc., 67 Wall St., New York City, as one of a series of Technical Information bulletins on monel metal and nickel alloys.

THE STRENGTH AT HIGH TEMPERATURES OF A CAST AND A FORGED STEEL AS USED FOR TURBINE CONSTRUCTION. By H. J. Tapsell and A. E. Johnson. 33 pages, 6 by 9½ inches. Distributed by the British Library of Information, 270 Madison Ave., New York City. Price, 20 cents, postpaid.

MECHANICAL WORLD ELECTRICAL POCKETBOOK (1932). 335 pages, 4 by 6 inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price, 1/6, net.

This is the twenty-fifth edition of this little electrical pocketbook, which contains a collection of electrical engineering notes, rules, tables, and data. In the new edition the sections on power plant operation, electric traction, and lamps and lighting have been revised and brought up to date. Also, an entirely new section on electric welding and cutting has been included. The usual classified buyer's directory is a feature of the book.

HOUGHTON ON QUENCHING. 80 pages; 30 charts and photomicrographs. Published by the Research Staff of E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa. Distributed free of charge.

This book explains in simple terms the structural changes that take place in steel as the result of various heat-treatments. The important relationship between quenching temperature and the physical properties developed in the steel is pointed out. The book also presents the results of many years of research on the relation between quenching speed or rate of cooling and the structure developed by quenching. Many tables and charts give the cooling speeds of all the commonly used quenching liquids and show how the cooling speeds of these liquids are affected by temperature changes and by the period of time they are in use.

BUSINESS LAW. By Thomas Conyngton. 702 pages, 6 by 8½ inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $6.

This is the third revised edition of a work on business law that has proved its value in commerce and industry. It is a general reference book on the questions of law that confront the management of a business in its daily affairs. It is written in a direct and easily read manner, avoiding as far as possible involved legal terms. The book covers, first, legal procedure and law in general, and then proceeds to deal in detail with contracts, sales, agencies, negotiable instruments, insurance, employment, partnerships, corporations, property, wills and inheritance, debts and interest, bankruptcy, patents, trademarks, copyrights, taxation, and arbitration. A large number of the customary legal forms are included. The book should prove of value to the manager of any business.

CHEVROLET SIX CAR AND TRUCK. By Victor W. Page. 489 pages, 5 by 7½ inches. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, $2.

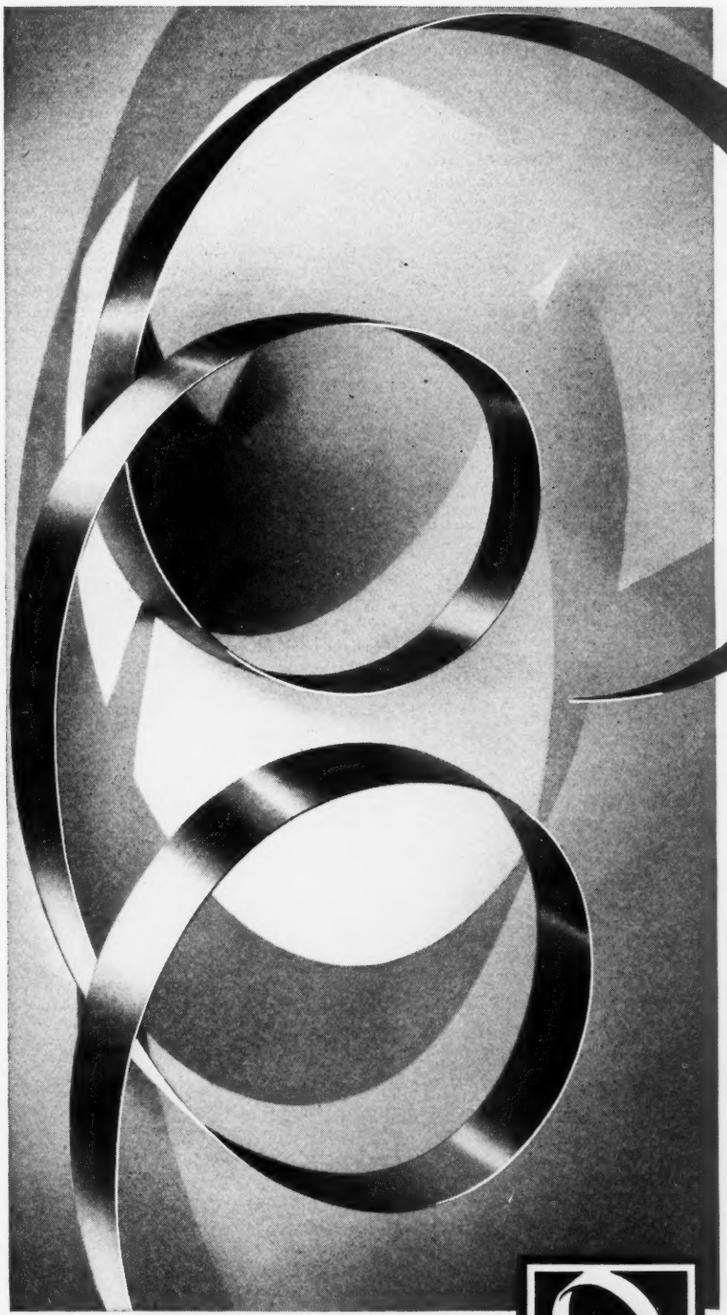
This work on the construction, operation, and repair of the Chevrolet car has been prepared with the full cooperation of the factory service department, and is illustrated with clear drawings showing all mechanical parts. The construction and operation are described in a simple, non-technical way with a view to giving the ordinary driver sufficient knowledge to service and repair his own car. The general repairman will find many short-cuts explained for repairing all parts of the car, and various special tools and fixtures are described in detail to facilitate the work. Suggestions are given for driving and upkeep, power plant overhauling, systematic location of defects in the carburetion, cooling, or ignition systems, as well as complete instructions and description of the new downdraft carburetor. The synchro-mesh and freewheeling transmission is explained in detail.

MANUAL OF COST PROCEDURES, AS RECOMMENDED BY THE NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION. Published by the Association, 1415 Enquirer Bldg., Cincinnati, Ohio. Price, $20.

This mimeographed manual of cost procedure, based on a long study made by the cost accounting staff of the National Machine Tool Builders' Association, has been prepared with a view to providing management with information that will enable it to thoroughly control all items pertaining to costs. The methods and principles outlined will apply in any manufacturing industry and especially in the machinery and metalworking industries. The list of contents will best indicate the wide scope of the work, there being in all, fifteen chapters, as follows: Reports for Executives; Estimating and Pricing; Development Work; Purchasing and Accounts Payable; Inventory Control; Orders; Labor Costs; Plant Asset Records; Burden; Machining Parts; Assembling Cost; Crating and Shipping; Shop Losses; Marketing Costs; and General Accounting Principles. It is doubtless the most complete and practical cost manual ever prepared.

SYMPOSIUM ON EFFECT OF TEMPERATURE ON METALS. 829 pages, 6 by 9 inches. Published jointly by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa., and the American Society of Mechanical Engineers, 29 W. 39th St., New York City. Price, $6.

This book contains a collection of twenty-seven papers presented at the joint symposium held in Chicago last summer, under the auspices of the two societies mentioned in the foregoing. The book represents the collected knowledge of many engineers in different fields. The papers are separated into two main divisions: First, engineering trends and requirements for metals at high and low temperatures; second, properties of available metals for high- and low-temperature service. The aim has been to make the book a ready reference volume in respect to both specific and general topics relating to temperature effect on metals. There is a specially prepared introduction that summarizes the more important points in the papers. For those who wish to make a study of the great mass of data in the book, there is an extensive subject index and an author's index, as well as a bibliography of 600 references.



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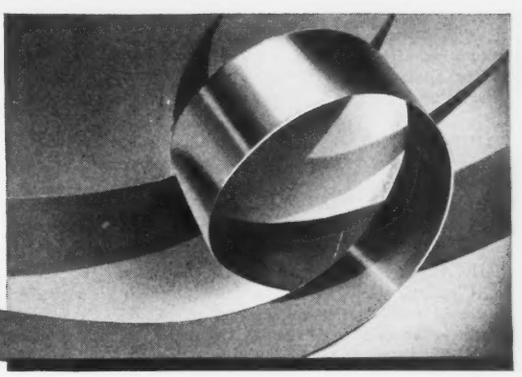

New Catalogues and Circulars

BELTING. Diamond Rubber Co., Inc., Akron, Ohio. Folder describing Diamond transmission belts.

BELT DRESSING. Diamond Rubber Co., Inc., Akron, Ohio. Blotter announcing dressing for rubber belts.

METALS. E. W. Blatchford Co., 63 Park Row, New York City. First issue of a publication known as "The Blatchford Buy-Metalist."

GAS PUMPS. International-Stacey Corporation, Columbus, Ohio. Bulletin 31-B10, describing Victor-Acme gas pumps for industrial service.

SPEED REDUCERS. Janette Mfg. Co., 556-558 W. Monroe St., Chicago, Ill. Bulletin illustrating and describing Janette motorized speed reducers.

ELECTRIC MOTORS. Bodine Electric Co., Oakley Blvd. and Ohio St., Chicago, Ill. Bulletin 1014, descriptive of Bodine constant-speed motors with worm-gear speed reducers.

ELECTRIC EQUIPMENT. Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis. Bulletin 726, illustrating and describing the Bulletin 726, high-tension, across-the-line starting switch.

SAW BENCHES. Oliver Machinery Co., Grand Rapids, Mich. Circular illustrating and describing the Oliver No. 70 ball-bearing "Variety" saw bench, with automatic saw guard.

LATHES. Boye & Emmes Machine Tool Co., Caldwell Drive, Cincinnati, Ohio. Catalogue illustrating and describing in detail the construction of Boye & Emmes lathes and attachments.

BEAM CLAMPS. General Electric Co., Schenectady, N. Y. Bulletin 1192A, containing data on G-E galvanized beam clamps for mounting equipment on steel members of standard shape.

MAGNETIC SEPARATORS. Magnetic Mfg. Co., Milwaukee, Wis. Bulletin 10, descriptive of the new Stearns Type K induction magnetic separator for separating different kinds of metals.

MICA UNDER-CUTTERS. Ideal Commutator Dresser Co., 1005 Park Ave., Sycamore, Ill. Folder illustrating and describing the 1932 model universal mica under-cutter made by the company.

ROLLER BEARINGS. Tyson Roller Bearing Corporation, Massillon, Ohio. Loose-leaf engineering manual, containing essential information on the application of Tyson cageless tapered roller bearings.

MOTORS. Reliance Electric & Engineering Co., 1042 Ivanhoe Road, Cleveland, Ohio. Bulletin 211, illustrating and describing the new Reliance Type T direct-current motors which range in size from 100 to 350 horsepower.

METAL STAMPINGS. Geometric Stamping Co., Cleveland, Ohio. Reference book profusely illustrated with charts, graphs, and tables, intended as an aid to designing engineers and others using stampings, forgings, and castings.

STEEL. Ludlum Steel Co., Watervliet, N. Y. Circular describing Ontario air-hardening die steel, containing detailed technical information relating to the characteristics, heat-treatment, machining, and properties of this grade of steel.

GRINDING MACHINES. Churchill Machine Tool Co., Ltd., Broadheath, Manchester, England. Leaflet OSG.1, illustrating and describing the outstanding features of Churchill open-side surface-grinding machines, with hydraulic table traverse.

ELECTRIC EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Bulletin entitled "Engineering Achievements—1931," outlining the developments that have taken place in various engineering fields during the past year.

MOTORS. Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Loose-leaf bulletin 167, descriptive of Wagner RP polyphase squirrel-cage motors. Loose-leaf bulletin 173, descriptive of Wagner Type RG repulsion-induction motors.

AIR GRINDERS. Madison-Kipp Corporation, 203 Waubesa St., Madison, Wis. Catalogue entitled "Miracle Kipp Air Grinder," illustrating and describing this equipment, as well as lubricators, die-casting machines, air tools, and the Kipp Steel Writer.

CORK PRODUCTS. L. Mundet & Son, Inc., 461 Eighth Ave., New York City. Publication entitled "Jointite Cork Products," giving information on the application of cork for insulation purposes, including soundproofing and the deadening of vibration.

ELECTRICAL CONDUCTORS. Aluminum Co. of America, Pittsburgh, Pa. Booklet describing "Channeluminum" electrical conductors—aluminum conductors made from channel sections, which have been developed to give the maximum in bus bar efficiency.

STEEL BALLS. Hoover Steel Ball Co., Ann Arbor, Mich., is issuing a monthly publication known as "The Hoover Sphere," which will contain information on Hoover balls, ball bearings, and roller bearings, together with items of human interest and bits of philosophy.

STEEL. Vanadium-Alloys Steel Co., Colonial Steel Co., and Anchor Drawn Steel Co., Grant Bldg., Pittsburgh, Pa. Catalogue entitled "High Speed Steels," giving information and data pertaining to the different grades of high-speed steel manufactured by the companies mentioned.

DROP-FORGINGS AND DROP-FORGED TOOLS. J. H. Williams & Co., 75 Spring St., New York City. Twenty-first edition of the company's complete catalogue of drop-forgings and drop-forged tools, including Supersocket wrenches and Vulcan Superior chain pipe tongs.

PRESSES AND SHEARS. Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Pamphlet entitled "Production Methods in the Manufacture of Refrigerator Cabinets," describing the use of Niagara presses, shears, folders, and brakes on this class of work.

STEEL. Electro Metallurgical Co., Unit of Union Carbide & Carbon Corporation, Carbide and Carbon Bldg., 30 E. 42nd St., New York City. Technical bulletin No. CV-1 on chrome-vanadium nitriding steel. The bulletin describes the properties and advantages of nitriding steel containing chromium and vanadium.

LATHES, RADIALS, AND SHAPERS. American Tool Works Co., Cincinnati, Ohio. Folder entitled "Facts Beyond Dispute," illustrating and describing 1931 models of the company's machines, and giving comparisons of actual results obtained with the present machines and those built ten years ago.

CORROSION-RESISTING MATERIAL. Skybryte Co., 1919 E. 19th St., Cleveland, Ohio. Circular descriptive of the physical characteristics and field of application of Rust-Tox, a corrosion-resisting material intended to protect metal surfaces that are exposed to corrosion and also to prevent further corrosion of rusted parts.

CLUTCHES. Ramsey Chain Co., Inc., 1039 Broadway, Albany, N. Y. Bulletin 132, illustrating and describing the Ramsey-Pulvis clutch—a new design of automatic, high-speed, mechanical load starter and shock absorber. The details of construction of the clutch, the operating characteristics, and general applications are described.

CHAINS AND SPROCKETS. Chain Belt Co., 1602 W. Bruce St., Milwaukee, Wis. Catalogue 440 entitled, "Rex Roller Chains and Sprockets." This is a book of over one hundred pages, 8 by 10½ inches, attractively bound, and containing, in addition to the catalogue information, a great deal of engineering data useful in selecting and applying chains and sprockets.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Circulars GEA-924B and 1084A treating, respectively, of switchboard devices—indoor bus supports—and plate-type field rheostats. Catalogues 1123A on outdoor switching equipment; 1262B on thrustors; 1372A on electric steam generators; and 885B on super synchronous motors.

ALUMINUM. Aluminum Co. of America, Pittsburgh, Pa. Booklet entitled "Alcoa Aluminum and Its Alloys," containing concise information concerning the physical and chemical properties of these aluminum alloys. The book also contains tables showing the sizes of the basic commodities manufactured from these alloys, and gives commercial tolerances for the various commodities.

CLEANING AND DRYING MACHINES. Metalwash Machinery Co., Inc., 117 E. 24th St., New York City. Catalogue describing Metalwash horizontal, flexible, wire-mesh, belt-conveyor machines for washing, rinsing, and drying metal parts; continuous conveyor air-blast drying machines; overhead return-conveyor twin-tunnel drying machines for racked parts; helical-screw, rotary-drum, hot-air-blast drying machines; and rotary drum-type washing, rinsing, and drying machines.

SCREWS AND SCREW PRODUCTS. Parker-Kalon Corporation, 200 Varick St., New York City. Catalogue of Parker-Kalon products, illustrating and describing a wide range of screws and other fastening means for making fastenings to sheet metal, steel, cast iron, die-castings, brass, Bakelite, slate, ebony, asbestos, and masonry, and for fastening sheet metal to wood. This is an unusually attractive catalogue containing a great deal of engineering information of value to designers and prospective users and giving specific information about the application of the company's sheet-metal screws, drive screws, screw nails, and masonry nails. Numerous illustrations indicate clearly the applications and uses of the various products.